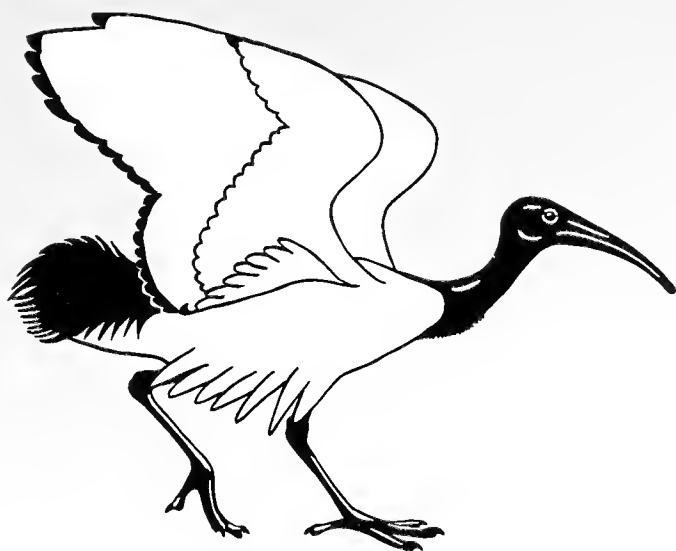


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# Bulletin of the British Ornithologists' Club

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Volume 134 No. 4  
December 2014



## FORTHCOMING MEETINGS

See also BOC website: <http://www.boc-online.org>

BOC MEETINGS are open to **all**, not just BOC members, **and are free**.

Evening meetings are in **an upstairs room at The Barley Mow, 104 Horseferry Road, Westminster, London SW1P 2EE**. The nearest Tube stations are Victoria and St James's Park; and the 507 bus, which runs from Victoria to Waterloo, stops nearby. For maps, see [http://www.markettaverns.co.uk/the\\_barley\\_mow.html](http://www.markettaverns.co.uk/the_barley_mow.html) or ask the Chairman for directions.

The cash bar opens at **6.00 pm** and those who wish to eat after the meeting can place an order. **The talk will start at 6.30 pm** and, with questions, will last c.1 hour.

*It would be very helpful if those intending to come can notify the Chairman no later than the day before the meeting.*

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**Tuesday 10 March 2015—6.30 pm—Dr Clemency Fisher—***A jigsaw puzzle with many pieces missing: reconstructing a 19th-century bird collection*

*Abstract:* In 1838–45, 'The Birdman' John Gould's assistant, John Gilbert, collected more than 8% of the bird and mammal species of Australia for the first time. He sent hundreds of specimens back to Gould, who used many of them to describe new species and then recouped his outlay by selling the specimens to contacts all over the world. Some of the new owners removed Gilbert's labels and mounted their specimens for display; some put new ones on, or placed their specimens into poor storage where both specimen and label were eaten by beetle larvae. Still others were swapped, listed as 'duplicates', or discarded. Reconstructing Gilbert's collections has been a monumental task over the last 35 years, aided greatly by a recent Leverhulme Trust Research Fellowship. The huge database developed has made it possible to see patterns and links in what is in effect a jigsaw puzzle with few pieces, and many of which are damaged.

*Biography:* Clemency Fisher is Senior Curator of Vertebrate Zoology at National Museums Liverpool, where she has worked for c.40 years. Although her primary research concerns John Gilbert, she was awarded the John Thackray medal for her work on Edward Stanley, 13th Earl of Derby, whose collections founded the then Liverpool Museum and which she now curates. She is a committee member of the Edward Lear Society, being responsible for promoting Lear's zoological artworks, and has also worked on bats, bird bones from archaeological digs and the history of wildlife art. Clem also spent part of her time in 2006–11 as Natural History Liaison Officer for the Museum of Liverpool content team, researching local history (especially that of Toxteth Deer Park) for the new museum's displays.

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**Tuesday 19 May 2015—5.30 pm—Annual General Meeting**, followed at **6.30 pm** by **Henry McGhie—***Who do you think you are, Henry Dresser? Birds, books and business*

Full details will appear in the March Bulletin.

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A further Tuesday evening meeting in 2015 is scheduled for **22 September**. In addition, a one-day joint meeting with the Ornithological Society of the Middle East and the Natural History Museum is currently being planned for a Saturday in November 2015.

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**The Chairman:** Chris Storey, 22 Richmond Park Road, London SW14 8JT UK. Tel. +44 (0)208 8764728. E-mail: [c.storey1@btinternet.com](mailto:c.storey1@btinternet.com)

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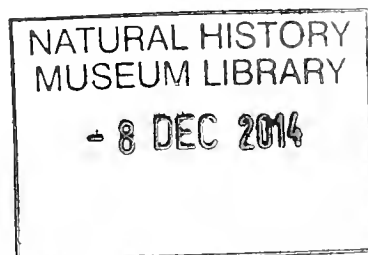
## CLUB ANNOUNCEMENTS

At the Special General Meeting on Tuesday 23 September 2014 (announced in *Bull. Brit. Orn. Cl.* 134: 77), Richard W. Malin was appointed *Hon. Treasurer* in place of David J. Montier. The Club is most fortunate that Richard has agreed to assume from David the considerable task of managing our finances. The AGM in 2015 will be the appropriate time to pay tribute to all that David has done for the Club during his tenure as *Hon. Treasurer*. I am delighted that in the meantime we will continue to benefit from his considerable experience and wise counsel, particularly in respect of determining the Club's future role.

Chris Storey

## REFEREES

I am grateful to the following, who have reviewed manuscripts submitted to the Bulletin during the last year (those who refereed more than one manuscript are denoted by an asterisk in parentheses): Mark Adams, Michael Andersen, Richard C. Banks, John M. Bates, Tim Birkhead, W. R. P. Bourne, Frederik Brammer, Michael Brooke, Leandro Bugoni, Bill Clark, Nigel Cleere (\*), Nigel Collar, Martin Collinson, Adrian Craig, Marco Aurelio Crozariol, Andrés Cuervo, Ron Demey, Thomas M. Donegan (\*), Tulio Dornas (\*), Robert J. Dowsett (\*), Jack Dumbacher, Guy Dutson, James Eaton, Chris Feare, Errol Fuller (\*), Anita Gamauf, David Gibbs, Steve N. G. Howell (\*), Julian P. Hume, Justin Jansen, Alan G. Knox (\*), Niels Krabbe, Mary LeCroy (\*), Alexander C. Lees, Graham Martin, Peter Mundy, Fernando Pacheco (\*), Robert Payne (\*), Utku Perktaş, H. D. Pratt, Robert Prÿs-Jones (\*), Paulo Pulgarín, Pamela C. Rasmussen, Robert S. Ridgely, Mark B. Robbins (\*), Peter Ryan, Richard Schodde, Thomas S. Schulenberg, Frank D. Steinheimer (\*), Jean-Claude Thibault (\*), Don Turner, Colin Trainor, David R. Wells, Andrew Whittaker and Glyn Young. — THE HON. EDITOR



# Clarification of collection data for the type specimens of Hutton's Shearwater *Puffinus huttoni* Mathews, 1912, and implications for the accuracy of historic subantarctic specimen data

by Alan J. D. Tennyson, Colin M. Miskelly & Mary LeCroy

Received 3 January 2013; final revision accepted 5 August 2014

**SUMMARY.**—Collection information for the type material of Hutton's Shearwater *Puffinus huttoni* Mathews, 1912, has long been debated. Contrary to some previous studies, we conclude that Sigvard Dannefaerd did not collect the holotype, now in the American Museum of Natural History (New York), nor was it collected in 1894. A more plausible scenario is that Henry Travers shot it off the subantarctic Snares Islands in January 1890. A sole paratype of the taxon, previously overlooked in the Natural History Museum (Tring), was perhaps collected in South Australia. Dannefaerd never visited New Zealand's subantarctic region, so several other type specimens supposedly collected by him there in 1894 must also have incorrect collection data.

Miskelly *et al.* (2001: 33–34) discussed the uncertainty surrounding the sex, collection location, collection date and collector of the holotype of Hutton's Shearwater *Puffinus reinholdi huttoni* Mathews, 1912 (now *Puffinus huttoni* Mathews, 1912), held in the American Museum of Natural History, New York (AMNH 527761; see Fig. 1). They concluded that it was a female that may have been collected at sea off The Snares, probably in 1894, by either Sigvard Dannefaerd or Henry Travers, or bought by one of these men from another collector. Since then we have located a paratype of the taxon and uncovered further information about the holotype's provenance and convoluted history.

The original description of Hutton's Shearwater (Mathews 1912: 77) does not clearly identify the specimens used for the type description, stating only that the 'Type' was in Mathews' collection and that 'a bird in the British Museum sent from the Adelaide Museum as having been obtained at Adelaide, South Australia, is referable to this southern form'. Additionally, Mathews noted that the taxon occurs in 'South Australia (accidental); Snares Island (breeding)', described the 'Adult male' and stated that the 'Adult female' is 'Similar to the male'. Clearly the description was based on at least two specimens which, by definition, must be types. AMNH 527761 has long been identified as the 'Type' (now holotype) but, confusingly, Greenway 1973 referred to it as both the holotype and, wrongly, as the lectotype. We are confident that AMNH 527761 is the holotype because it bears a Mathews' type label filled out in his own hand and it is the only Hutton's Shearwater in the AMNH that was in Mathews' collection. The South Australian specimen specifically referred to in the description is a paratype. It appears that Mathews (1912: 76) considered two other specimens in Walter Rothschild's collection at Tring to be also Hutton's Shearwaters, although they are not specifically mentioned in his formal description on the following page, so we do not consider them to be types. One of these other two specimens was apparently AMNH 527760—a male Fluttering Shearwater *Puffinus gavia* (J. R. Forster, 1844) with the same collection data as the Hutton's Shearwater holotype (see Miskelly *et al.* 2001). This is corroborated by one of the labels on AMNH 527760, which reads '*Puffinus reinholdi huttoni*', in Mathews' hand. The second bird was not specified by Mathews (1912), but it may well

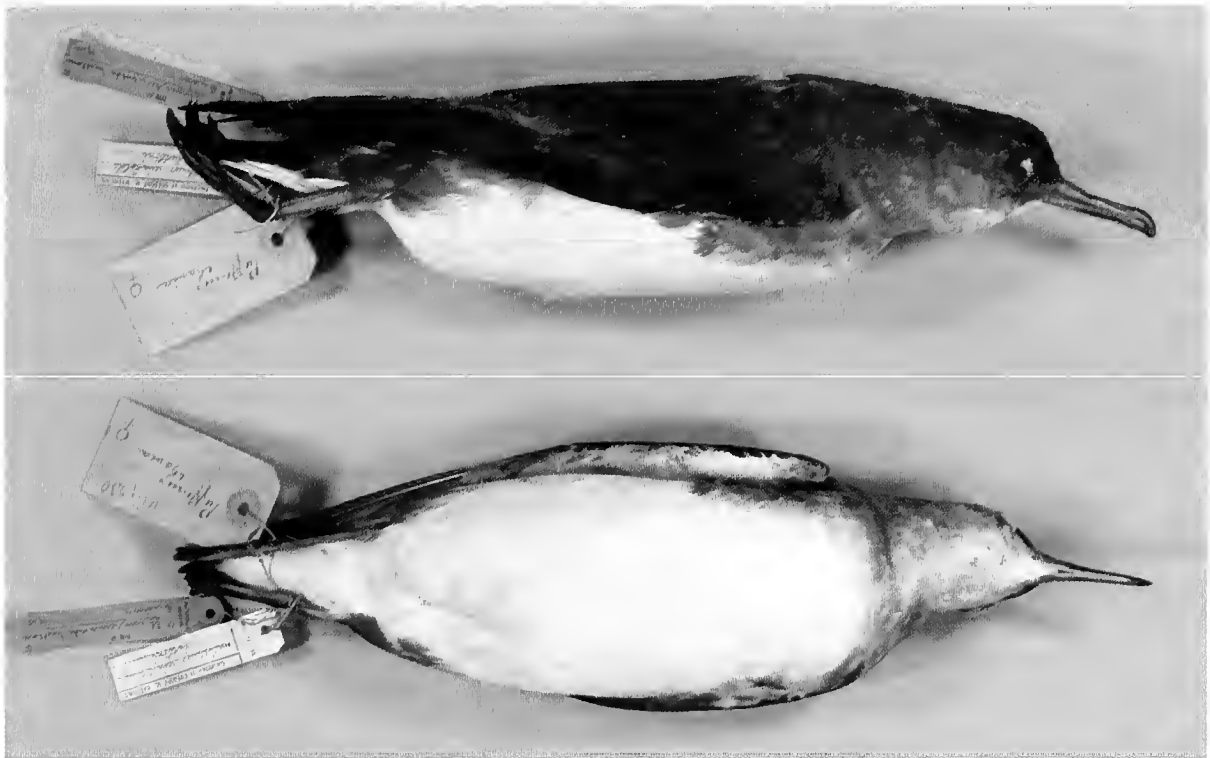


Figure 1. The holotype of Hutton's Shearwater *Puffinus huttoni* Mathews, 1912; AMNH 527761 (© Matthew Shanley, American Museum of Natural History, New York)

be Fluttering Shearwater AMNH 527762, which is also a Dannefaerd bird, from 'New Zealand Seas' and labelled '*Puffinus reinholdi huttoni*' in an unknown hand.

When Mathews (1912: 76) examined these shearwaters in Rothschild's collection, the bird that subsequently became the holotype of Hutton's Shearwater was also part of this collection. By 1912, and after Godman examined it (Godman 1907–08), Mathews had evidently obtained this specimen for his own collection 'in exchange' from Rothschild (Hartert 1926: 348, Miskelly *et al.* 2001). Lists of exchanges to Mathews from Rothschild include single '*Puffinus gavia*' in both 1908 and 1910, but further details are lacking (AMNH, Ornithology Dept. archives). Contrary to a note reading 'G.M. Mathews coll.?' in the AMNH catalogue opposite AMNH 527760, and Miskelly *et al.* (2001), there is no evidence to suggest that Mathews ever had both Dannefaerd Snares shearwater specimens in his possession, but he had examined both in Tring. AMNH records indicate that the second Dannefaerd Snares shearwater specimen (Fluttering Shearwater; AMNH 527760) remained in Rothschild's collection until that was sold to the AMNH.

Specimen AMNH 527760 is one of the southernmost records of Fluttering Shearwater, but its collecting location has been questioned (Miskelly *et al.* 2001). Although these authors considered the collection data to be doubtful, it gains some support from a record of a mummified Fluttering Shearwater found by K. G. Simpson much further south, on

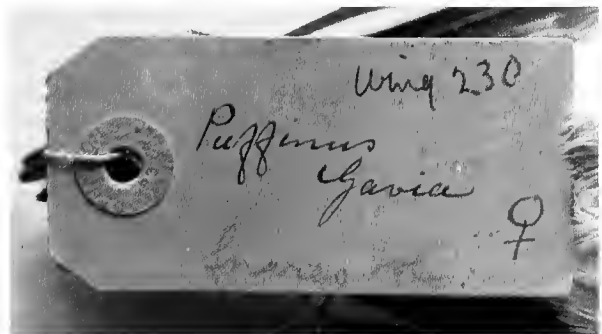


Figure 2. Label of the holotype of Hutton's Shearwater *Puffinus huttoni* Mathews, 1912; AMNH 527761; the scientific name, sex and collection location are written by Sigvard Dannefaerd; 'wing 230' is in Mathews' hand (© Matthew Shanley, American Museum of Natural History, New York)

Macquarie Island, in 1965 (Australian National Wildlife Collection (ANWC) no. 10602: AJDT pers. obs. December 2003).

The bird that we consider to be the sole paratype of Hutton's Shearwater had been overlooked and remained unlabelled as such in the Natural History Museum (BMNH), Tring, until 2011 (J. H. Cooper *in litt.* 2011), despite Mathews' (1912: 77) clear reference to the specimen (see above). This specimen (BMNH 1888.12.9.7) was acquired from the London dealer Edward Gerrard Jr. with a batch of seven other birds originating from the museum in Adelaide (J. H. Cooper *in litt.* 2011). All eight birds have the locality recorded as 'Adelaide', yet some of the relevant taxa do not occur near Adelaide, so their locality information is unreliable and may be wrong (J. H. Cooper *in litt.* 2011). It seems probable that the location 'Adelaide' was attached to the birds simply because they originated from the museum in Adelaide. The registration dates indicate that this batch was received at BMNH in or before 1888, but no further collection details or sex are available for the shearwater. R. A. Falla confirmed the identification in 1962, noting on the label 'This is *huttoni*' (J. H. Cooper *in litt.* 2011). Mathews (1912) noted that its occurrence in South Australia was 'accidental', but he subsequently expunged the record altogether (Mathews 1919: 421–422, *cf.* Serventy 1939). Despite the uncertainty around the true collection location of the paratype, it is now known that South Australian waters are part of the normal range of Hutton's Shearwater (Serventy 1939, Marchant & Higgins 1990), and so the paratype may well have been collected there.

The location of the type locality near The Snares is corroborated by an unpublished letter dated 16 May 1895 from Dannefaerd to Rothschild (Miskelly *et al.* 2001). In this letter, Dannefaerd emphasised that The Snares location was correct because, he added, 'Puffinus Gavia is considered very rare her[e]', as an annotation at the end of the inventory of specimens shipped, which included '2 Puffinus Gavia Snares Isl'. This was before Hutton's Shearwater had been described and so specimens of this species would have been considered to be Fluttering Shearwaters. In fact, one was a Fluttering Shearwater (AMNH 527760) and the other a Hutton's Shearwater (AMNH 527761). Although Hutton's Shearwater has not been reported as far south as The Snares recently, the population was probably much greater in number and distribution in the past (Tennyson 2010), therefore it probably had a broader marine range in the 19th century.

Although Dannefaerd supplied the holotype of Hutton's Shearwater to Rothschild, we now possess conclusive evidence that Dannefaerd was not the collector, despite Greenway (1973) stating that it was 'collected by Dannefaerd in March, 1894'. By searching the Papers Past website ([www.paperspast.natlib.govt.nz](http://www.paperspast.natlib.govt.nz); digitised New Zealand newspapers and periodicals) and other sources (e.g. Cumpston 1968), we have found no evidence that Dannefaerd ever travelled to New Zealand's subantarctic islands (*contra* Murphy 1952) or, in fact, that any vessels visited those islands in March 1894. Further evidence supporting this conclusion is an unpublished letter from Henry Travers to Ernst Hartert, Rothschild's curator, dated 14 May 1895: 'Mr Dannefaerd ... never collected the Miro [= Snares Island Tomtit *Petroica macrocephala dannefaerdi* (Rothschild, 1894)] from the Snares recently named after him, as he never was there...' (BMNH archives; *cf.* Miskelly 2012). The sources of most New Zealand subantarctic bird specimens in the late 19th century were collectors aboard Government steamers—in 1894 the first Government steamer visit to the subantarctic was between 25 April and 24 May (*Southland Times* 26 April 1894, *Otago Witness* 24 May 1894). We therefore conclude that the 'March 1894' date associated with the holotype by Greenway is not its collection date, rather Dannefaerd bought the holotype from another collector and then labelled it himself (Fig. 2), sometime before May 1895, when he sent it to Rothschild. In fact, Greenway appears to have simply made an error in giving March 1894 as the collection date, as apparently he is the first person to have associated this date with the specimen.

While we conclude that Dannefaerd could not have collected the holotype of Hutton's Shearwater, we have found further evidence that Henry Travers might have been the collector. Godman (1907–08) and Waite (1909, apparently following Godman) stated that a shearwater, probably the holotype of Hutton's Shearwater (*cf.* Miskelly *et al.* 2001), was collected by Travers. Travers personally collected on New Zealand's subantarctic islands twice: during 8–20 January 1890 (*Otago Daily Times* 21 January 1890, Chapman 1891, Cumpston 1968: 147) and from 25 April to 24 May 1894 (*Southland Times* 26 April 1894, *Otago Witness* 24 May 1894). This is contrary to the previous conclusion by Miskelly *et al.* (2001) that Travers only collected in this region in 1894 (Miskelly *et al.* 2001, based on R. A. Falla *in* Warham & Bell 1979). We still have not been able to trace the source of the holotype's collection date of January 1890 given by Clark & Fleming (1948) and subsequently used by Oliver (1955; Te Papa archives MU000233/016/0004), but it may well be correct as it ties in with Travers' activities. Perhaps Clark & Fleming (1948) deduced the date using similar evidence to ours. In 1890 Travers was at The Snares only on 9 January, where he was actively collecting birds at sea (Chapman 1891). In contrast, the likelihood of Travers collecting a Hutton's Shearwater on his 1894 trip seems slim. After leaving Bluff on 25 April 1894, Travers must have visited The Snares in late April because he collected specimens of the Snares Island Tomtit (LeCroy 2008: 250) and Snares Island Fernbird *Bowdleria punctata caudata* (Buller, 1894), now at AMNH, in April 1894 (J. A. Bartle pers. comm. 1998)—not in May 1894 (Warham 1967)—before reaching the Auckland Islands by 1 May (*Poverty Bay Herald* 28 May 1894). Hutton's Shearwaters are rare in New Zealand waters in late April as most birds leave New Zealand prior to this, following the end of the breeding season (Harrow 1976, Marchant & Higgins 1990). Additionally, the plumage of the holotype shows no sign of active moult and little sign of wear. By April, the plumage of Hutton's Shearwaters should be worn, with post-breeding moult having begun, but in January their plumage should appear newer (Marchant & Higgins 1990). While we cannot rule out the possibility that an unknown sailor or passenger collected the holotype, we have no evidence to support such a theory. The specimen bears, in addition to Dannefaerd's label, Mathews and Rothschild type labels, but the original Rothschild label of the holotype is missing and was presumably removed by Mathews, as was his custom. This label would have been seen by Godman but it probably only would have borne the annotation 'Dannefaerd Coll.', as did most other specimens from the latter's collection. Hartert was probably the source of Godman's statement that Travers was the collector, as he knew by that time that Dannefaerd had never visited The Snares.

Unfortunately, doubt concerning the accuracy of the holotype's collection data is compounded because other information relating to Travers' and Dannefaerd's collections has proven unreliable (Boessenkool *et al.* 2010, Miskelly 2012) and Gregory Mathews was careless with data 'to the point of serious professional incompetence' (Rasmussen & Prŷs-Jones 2003). Nevertheless, we tentatively conclude that the holotype was shot at sea near The Snares by Henry Travers on 9 January 1890 and was subsequently sold to Dannefaerd. It appears that other birds collected by Travers at The Snares in 1890 were sold to Dannefaerd, e.g. three Snares Island Snipe *Coenocorypha luegeli* (Tristram, 1893), now AMNH 740429–431.

It is notable that several other important historic bird specimens from New Zealand subantarctic islands are reported as being collected in March 1894 and / or by Dannefaerd. These include the type specimens of *Miro dannefaerdi* (*cf.* Rothschild 1894), *Procellaria aequinoctialis steadi* Mathews, 1912, and *Heteropron desolatus alter* Mathews, 1912 (*cf.* Greenway 1973). We conclude that the collection information for these specimens must also be incorrect. Further research (e.g. determining the skinning techniques used by

Dannefaerd and Travers, or sexing using DNA) may yet resolve some of the uncertainty as to the collection details of these historically important specimens and the holotype of Hutton's Shearwater.

### Acknowledgements

We thank: Paul Sweet, Tom Trombone and Matthew Shanley (all AMNH), and Sandy Bartle for information on specimens at AMNH and / or images of specimens; the ornithology staff at ANWC for facilitating AT's visit; Joanne Cooper (Natural History Museum) for information concerning the paratype; Polly Parry (Natural History Museum) for a copy of Travers' letter; Trish James (Senior Document Examiner, New Zealand Police) for confirming Murphy's (1952) conclusion that the handwriting on the holotype's label is Dannefaerd's; Jennifer Twist (Te Papa) for access to Oliver's archives; Martin Lewis (Te Papa) for help with locating references; Jean-Claude Stahl (Te Papa) for assistance with Fig. 1; and Ricardo Palma (Te Papa), Joanne Cooper, Robert Prŷs-Jones (Natural History Museum) and Paul Scofield (Canterbury Museum) for reviewing the manuscript.

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## Noteworthy ornithological records from the threatened *campinas* of the lower rio Tocantins, east Amazonian Brazil

by Alexander C. Lees, Nárgila G. Moura, Arlete Silva de Almeida  
& Ima C. G. Vieira

Received 11 March 2014

**SUMMARY.**—Recent ornithological field work in previously poorly inventoried Amazonian enclaves of savanna and stunted forest have resulted in the discovery of many taxa previously thought absent from the biome and even undescribed species. Here we present ornithological observations of non-forest bird species from a series of *campina* physiognomies along the lower rio Tocantins in eastern Pará state, Brazilian Amazonia. Despite the area's relative proximity (c.90 km) to the state capital Belém (a long-term hub of Amazonian ornithology) we encountered several bird species previously unreported from the region. These included significant range extensions for species of conservation concern such as Ocellated Crake *Micropygia schomburgkii* and Rufous-sided Pygmy Tyrant *Euscarthmus rufomarginatus* (Near Threatened). We explore the biogeographical significance of these records in terms of postulated scenarios of colonisation of Amazonian savanna enclaves by non-forest species, and assess the threats that these communities face from current human activities.

Open-habitat enclaves are distributed patchily throughout lowland Amazonia, typically in areas with very leached and nutrient-poor sandy soils (Anderson 1981, Silva & Bates 2002). Their reduced structural complexity, patchy distribution, distinctive geomorphology and variable isolation from other 'source' patches mean that their biotas are often highly idiosyncratic and species-poor but distinguished by comparatively high rates of endemism (Anderson 1981). Renewed investment in ornithological surveys of these non-forest islands (e.g. Silva *et al.* 1997, Vasconcelos *et al.* 2011) has resulted in the discovery of many species previously thought absent from the biome and even the recent description of new range-restricted species (e.g. Cohn-Haft *et al.* 2013, Whitney *et al.* 2013). However major gaps remain in our knowledge of these disparate enclaves and plugging these 'Wallacean shortfalls' (*sensu* Lomolino & Heaney 2004) should be a conservation priority given rates of conversion and degradation of these unique ecosystems. Open-habitat enclaves on white-sand soils are often known as *campinas*, to differentiate them from open habitats on other soil types, e.g. savannas (e.g. Anderson 1981). *Campina* enclaves in the Brazilian Amazonian state of Pará are particularly poorly inventoried (Ferreira *et al.* 2013a,b). Although c.2% of the state is covered by *campina* formations (Ferreira *et al.* 2010), dedicated ornithological field work has apparently only been conducted on the large southern enclave of the Serra do Cachimbo (Pinto & Camargo 1957, Santos *et al.* 2011) and in the small fragmented *campina* north-east of Belém in the Zona Bragantina (Novaes & Lima 1992, Lees *et al.* 2014). This neglect is all the more serious considering the widespread loss and degradation of such *campina* habitats in easternmost Pará due to agricultural expansion and aggregate extraction (Vieira *et al.* 1967, Ferreira *et al.* 2013b).

A large complex of *campina* formations along the lower rio Tocantins, Pará, has apparently escaped modern ornithological field work and they were unmarked on the maps of principal Amazonian *campina* formations indicated in both Silva *et al.* (1997) and Aleixo &

Poletto (2007), although it has recently been explored by botanists (Ferreira *et al.* 2013b). We undertook ornithological field work along the lower Tocantins in September–October 2013, under the auspices of the ‘Projeto INCT Biodiversidade e Uso da Terra na Amazônia’ (CNPq / Museu Goeldi), whereby our primary aim was to establish the biodiversity consequences of rapidly expanding oil palm *Elaeis guineensis* plantations in the region (Butler & Laurance 2009, Lees & Vieira 2013). During our quantitative field work we were able to conduct largely opportunistic surveys of *campina* enclaves, of which we present the principal findings here, contextualised via reference to the literature and historical specimens.

## Methods

**Study landscape: climate and biophysical conditions.**—Regional climate is classified as Köppen-type Am, with mean temperatures around 25°C and relative humidity always >80%. Mean annual precipitation is c.2,200 mm concentrated between January and July (IDESP 2013). We identified two distinct *campina* physiognomies. In the municipalities of Moju and Tailândia were small pockets of tall-grass *campinas* (sward height c.30 cm; Fig. 2a) dominated by *Axonopus pubivarginatus* (Henr.), *Rhynchospora barbata* (Vahl.) Kunth, *Macrobium bifolium* Persoon, *Lagenocarpus rigidus* (Kunth) Nees, and *Sauvagesia sprengelii* A. St.-Hil. Closer to the Tocantins on both banks (Fig. 2b) there were extensive *campinas* dominated by grassy formations with scattered gnarled Cerrado trees. Ferreira *et al.* (2010, 2013b) found this area to be dominated by herbaceous plants such as *Syngonanthus tenuis* var. *bulbifer* (Huber), *Paepalanthus fertilis* Körn. (Eriocaulaceae), *Rhynchospora barbata* (Vahl) Kunth and *Lagenocarpus rigidus* Nees (Cyperaceae).

**Field work protocols.**—Survey work was undertaken by ACL & NGM along the east bank of the rio Tocantins (Fig. 1), in the municipalities of Moju and Tailândia between 11 September and 1 October 2013, and on the west bank of the Tocantins at Cametá on 2–5 October 2013. Our primary aim was to understand the biodiversity value of forest remnants and adjoining agricultural landscapes (principally oil palm but also cattle pasture) within three drainage catchments Ubá (9,580 ha), Arauá (9,513 ha) and Mamorana (6,791 ha). Within each catchment, we used a stratified random sampling design following our previous avian sampling protocols (see Lees *et al.* 2012, 2013) to help ensure that sample data provide a representative assessment of overall environmental condition. In each catchment a standard density of 300-m study transects was distributed across the landscape in proportion to the percentage cover of forest (primary and secondary) and production.

Within each of these major land-use categories sample transects were distributed randomly to increase the likelihood that we captured important internal heterogeneities in forest and / or production systems. A minimum separation distance rule of 1,500 m between transects was employed to minimise dependence between points. Using this survey methodology just a single area of undisturbed *campina* vegetation was selected for quantitative sampling (‘Moju 2’: 02°14’S, 48°50’W; Fig 1). However, given the ornithological importance of this habitat evident from the sample, we made repeated visits to as many patches as possible outside survey periods (principally ‘Moju 1’: 12°14’S, 48°50’W; Fig. 1). During this initial survey we conducted two repetitions of three fixed-width (75 m) 15-minute point counts per transect sited at 150 m-intervals along a 300 m-transect. Surveys were not undertaken on days with persistent rain and / or strong winds. After completing our quantitative survey work on 1 October, we travelled west to Cametá sampling *campinas* (Fig. 1) identified using Google Earth (version 4.3) with field work concentrated at ‘Cametá 1’ (02°08’S, 49°34’W), ‘Cametá 2’ (02°17’S, 49°40’W) and ‘Cametá 3’ (02°18’S, 49°17’W).

We compiled all records of ‘non-forest’ bird species that are not associated with aquatic ecosystems, following the classifications of Aleixo & Poletto (2007) and Mittermeier *et al.*

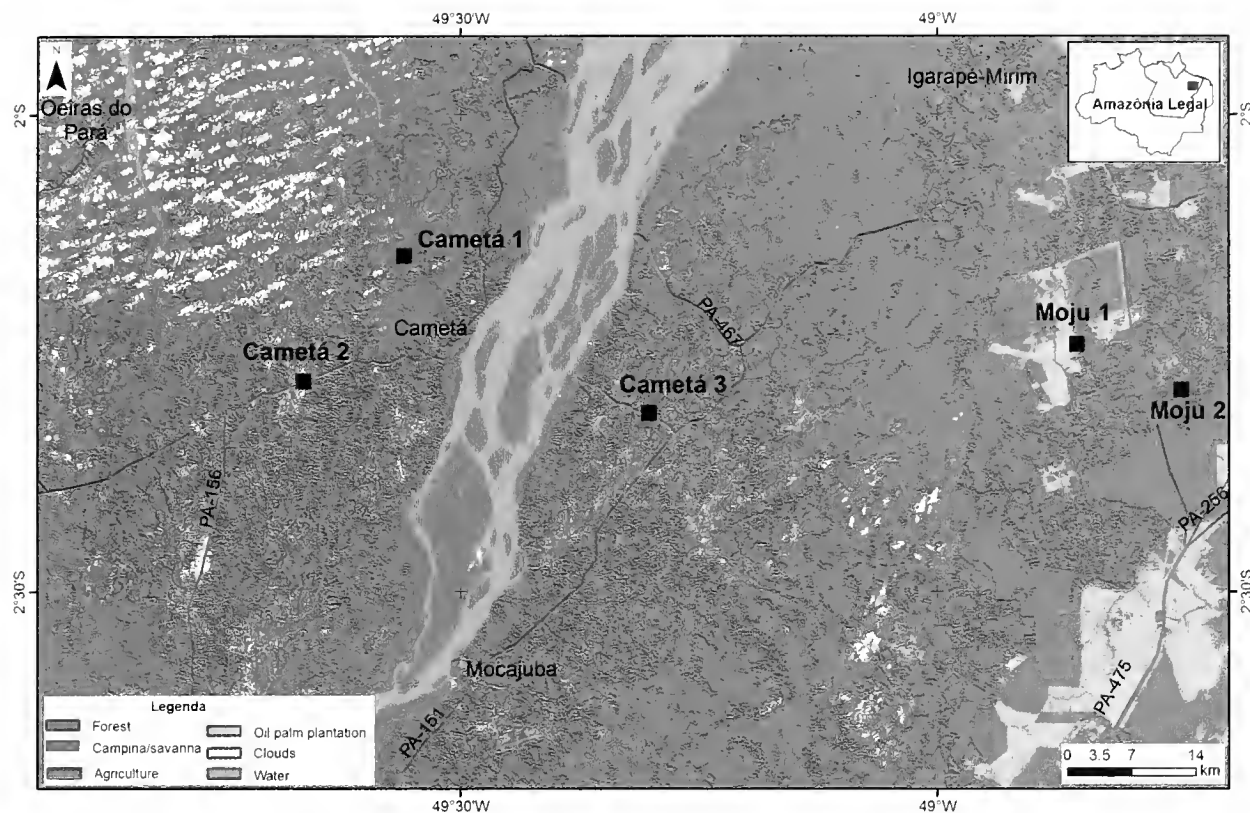


Figure 1. Map illustrating the position of the five principal sampling sites and major land-use types along the lower Tocantins.

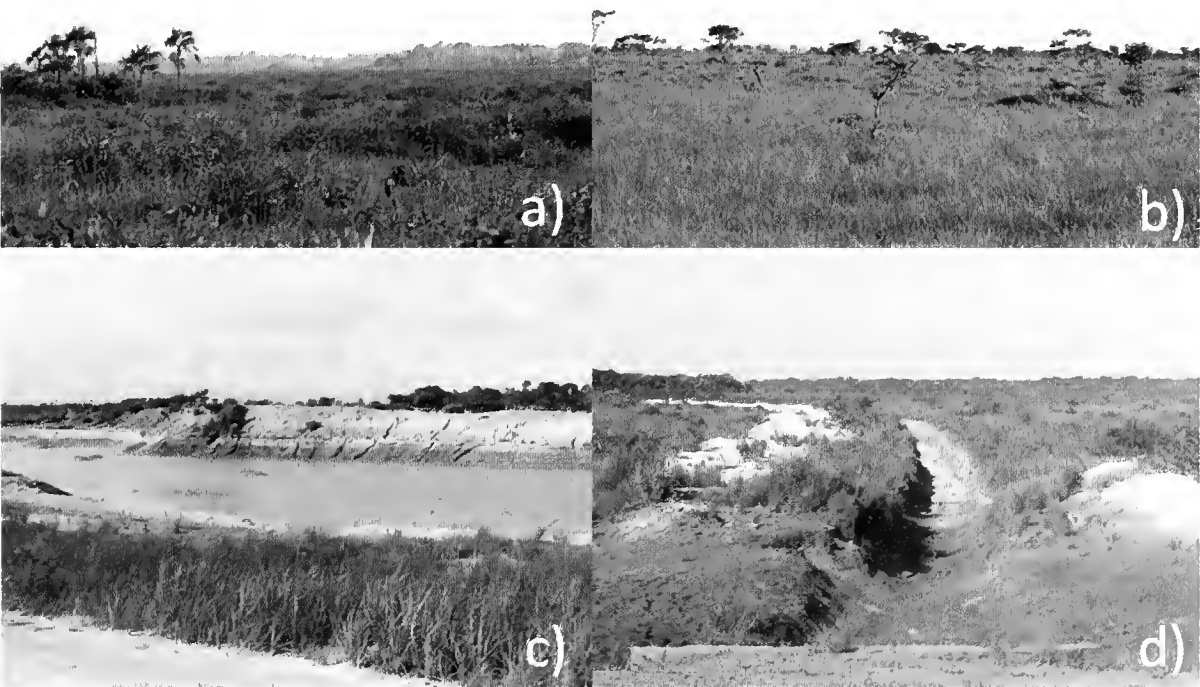


Figure 2. (a) herbaceous *campina* at Moju, Pará; (b) arborescent *campina* at Cametá, Pará, Brazil, in October 2013; (c) aggregate extraction on the west bank of the Tocantins at Cametá in October 2013; (d) drainage ditches dug into *campina* at Carapajó on the east bank of the Tocantins in October 2013 (A. C. Lees).

TABLE 1

List of 56 open-habitat species recorded from the lower Tocantins region, south of the Amazon (Pará, Brazil). Photo- and sound-reference numbers refer to the online databases of [www.wikiaves.com.br](http://www.wikiaves.com.br) (WA) and [www.xeno-canto.org](http://www.xeno-canto.org) (XC). Initials denote author records of species for which digital vouchers were not obtained. Habitat codes are as follows: C = *campina*, A = agriculture / silviculture (pasture, oil palm), U = urban.

Scientific name	English name	West bank	East bank	Habitat
<i>Crypturellus parvirostris</i>	Small-billed Tinamou		ACL, NGM	C,A
<i>Bubulcus ibis</i>	Cattle Egret	ACL, NGM	ACL, NGM	A
<i>Coragyps atratus</i>	Black Vulture	ACL, NGM	WA1240419	C,A,U
<i>Elanus leucurus</i>	White-tailed Kite		WA1240411	C,A
<i>Heterospizias meridionalis</i>	Savanna Hawk	ACL, NGM	WA1163992	C,A
<i>Geranoaetus albicaudatus</i>	White-tailed Hawk	ACL, NGM	WA1169115	C,A
<i>Caracara plancus</i>	Southern Caracara	ACL, NGM	WA1088715	C,A,U
<i>Milvago chimachima</i>	Yellow-headed Caracara	ACL, NGM	ACL, NGM	C,A,U
<i>Falco sparverius</i>	American Kestrel		ACL	U
<i>Falco femoralis</i>	Aplomado Falcon		ACL	A
<i>Micropygia schomburgkii</i>	Ocellated Crake		XC149795	C
<i>Laterallus viridis</i>	Russet-crowned Crake	ACL, NGM	ACL, NGM	C,A
<i>Porzana albicollis</i>	Ash-throated Crake	ACL, NGM	XC149795	C,A
<i>Columbina passerina</i>	Common Ground Dove	WA1241457	WA1167084	C,A,U
<i>Colombina minuta</i>	Plain-breasted Ground Dove	ACL, NGM	WA1170904	A
<i>Columbina talpacoti</i>	Ruddy Ground Dove	ACL, NGM	WA1170896	C,A,U
<i>Patagioenas picazuro</i>	Picazuro Pigeon		ACL, NGM	C,A
<i>Zenaida auriculata</i>	Eared Dove	ACL, NGM		C,U
<i>Eupsittula aurea</i>	Peach-fronted Parakeet	ACL, NGM		C
<i>Crotophaga ani</i>	Smooth-billed Ani	ACL, NGM	WA1163940	C,A,U
<i>Guira guira</i>	Guira Cuckoo		ACL, NGM	C,A,U
<i>Tapera naevia</i>	Striped Cuckoo	ACL, NGM	WA1163938	C,A
<i>Tyto alba</i>	Barn Owl		ACL, NGM	A
<i>Athene cunicularia</i>	Burrowing Owl	WA1177607	ACL, NGM	C,A
<i>Hydropsalis torquata</i>	Scissor-tailed Nightjar	ACL, NGM	ACL	C
<i>Chordeiles pusillus</i>	Least Nighthawk	XC150403	WA1108262	C
<i>Chordeiles acutipennis</i>	Lesser Nighthawk	ACL, NGM	WA1240426	C,A
<i>Polytmus theresiae</i>	Green-tailed Goldenthrout	ACL, NGM	ACL, NGM	C,A
<i>Nystalus maculatus</i>	Spot-throated Puffbird	ACL, NGM	WA1170899	C,A
<i>Melanerpes candidus</i>	White Woodpecker		WA1169115	C,A
<i>Formicivora rufa</i>	Rusty-backed Antwren	WA1108187	WA1088763	C,A
<i>Synallaxis albescent</i>	Pale-breasted Spinetail	WA1241456	WA1112846	C,A
<i>Todirostrum cinereum</i>	Common Tody-Flycatcher		ACL, NGM	C,A,U
<i>Hemitriccus striaticollis</i>	Stripe-necked Tody-Tyrant		ACL	C
<i>Euscarthmus rufomarginatus</i>	Rufous-sided Pygmy Tyrant		WA1088760	C
<i>Elaenia cristata</i>	Plain-crested Elaenia	ACL, NGM	WA1240441	C,A
<i>Elaenia chiriquensis</i>	Lesser Elaenia		WA1240443	C
<i>Xolmis cinereus</i>	Grey Monjita	WA1111923		C
<i>Casiornis fuscus</i>	Ash-throated Casiornis		WA1088730	C
<i>Myiozetetes cayanensis</i>	Rusty-margined Flycatcher	ACL, NGM	ACL, NGM	C,A,U

<i>Anthus lutescens</i>	Yellowish Pipit	ACL, NGM	WA909541	C
<i>Saltator azarae</i>	Amazonian Greyish Saltator	ACL, NGM	ACL, NGM	C,A
<i>Tachyphonus rufus</i>	White-lined Tanager	ACL, NGM	WA1170903	C,A,U
<i>Schistochlamys melanopis</i>	Black-faced Tanager	WA1177611	WA1170898	C,A
<i>Schistochlamys ruficapillus</i>	Cinnamon Tanager		WA1088770	C
<i>Zonotrichia capensis</i>	Rufous-collared Sparrow	ACL, NGM	WA909543	C,A
<i>Ammodramus humeralis</i>	Grassland Sparrow	WA1177622	WA1240413	C,A,U
<i>Ammodramus aurifrons</i>	Yellow-browed Sparrow	ACL, NGM	WA1175341	C,A
<i>Emberizoides herbicola</i>	Wedge-tailed Grass Finch	WA1241455	WA1167085	C,A
<i>Sporophila plumbea</i>	Plumbeous Seedeater	ACL, NGM	WA1163939	C,A
<i>Sporophila americana</i>	Wing-barred Seedeater	ACL, NGM	WA1240420	C,A
<i>Sporophila nigricollis</i>	Yellow-bellied Seedeater	ZMB 31220	WA1088728	C,A
<i>Sporophila minuta</i>	Ruddy-breasted Seedeater	ACL, NGM	WA1167086	C,A
<i>Sporophila angolensis</i>	Chestnut-bellied Seed Finch		WA1175376	C,A
<i>Geothlypis aequinoctialis</i>	Masked Yellowthroat	ACL, NGM	WA1169108	C,A
<i>Sturnella militaris</i>	Red-breasted Blackbird	ACL, NGM	WA909544	C,A

(2010). We archived digital vouchers (photographs and sound-recording e-vouchers) on the internet to provide documentary evidence for species mentioned in the accounts. Images have been archived on the Brazilian archive WikiAves ([www.wikiaves.com.br](http://www.wikiaves.com.br)) and our sound-recordings on the global avian sound library xeno-canto ([www.xenocanto.org](http://www.xenocanto.org)). Material on both sites is searchable by the catalogue number provided in the text.

We compiled a list of specimens collected by previous field workers from the Museu Paraense Emílio Goeldi, Belém, Brazil (MPEG)—some of which are now held at the Museum für Naturkunde, Berlin (ZMB) and the Museu Nacional do Rio de Janeiro (MNRJ)—and used the digital database ORNIS [www.ornisnet.org/](http://www.ornisnet.org/) to search for other historical specimens. These searches retrieved relevant records in the collections of the American Museum of Natural History, New York (AMNH), Field Museum of Natural History, Chicago (FMNH) and Los Angeles County Museum of Natural History (LACM). Historic collecting localities were located using Paynter & Traylor (1991). Our taxonomy follows that of the Comitê Brasileiro de Registros Ornitológicos (CBRO 2014).

## Results

Our quantitative and qualitative bird surveys produced records of 56 non-forest bird species (Table 1). Such species were not necessarily restricted to *campina* habitats, with some also occupying cattle pastures and oil palm plantations, a separate quantitative evaluation of these trends will be published elsewhere (Lees in prep.). We present species accounts for the most noteworthy records below.

### OCCELLATED CRAKE *Micropygia schomburgkii*

ACL sound-recorded (XC149795) a single spontaneously vocalising individual from a tall-grass *campina* formation that had been planted with oil palms in the municipality of Moju, 'Moju 1', on 11 September 2013. The plantation was three years old but owing to the poor quality sandy soil had failed to flourish and *campina* grassland flora was well preserved between the rows of palms. We subsequently located a second territory 800 m from the first on 13 September 2013 in an open tall-grass *campina* physiognomy close to a stand of *Mauritiella armata* (Mart.) Burret palms. Our final record concerned a single that sang in



Figure 3. (a) female Rusty-backed Antwren *Formicivora rufa*, Cametá, Pará, Brazil, 3 October 2013; (b) Rufous-sided Pygmy Tyrant *Encarthmus rufomarginatus*, Moju, Pará, Brazil, 13 September 2013; (c) juvenile Grey Monjita *Xolmis cinerens* Cametá, Pará, Brazil, 3 October 2013; (d) pair of Cinnamon Tanagers *Schistochlamys ruficapillus* with Black-faced Tanager *Schistochlamys melanopsis*, Moju, Pará, Brazil, 12 September 2013 (A. C. Lees)

response to playback 3.6 km south of the second site (and in a similar habitat type) at 02°16'S, 48°49'W, on 18 November 2013 (XC155521). These birds' habitat choice is closely allied to that in Cerrado reported by Negret & Teixeira (1984), who found that Ocellated Crakes preferred dense dry grasslands dominated by *Tristachya leiostachya* (Graminae), adjacent to wetter palm groves or gallery forests, although the species often occurs in grasslands far from watercourses (A. Whittaker *in litt.* 2014). Although currently ranked as Least Concern by BirdLife International, all species restricted to humid *cerrado* are probably under threat ([www.icmbio.gov.br/portal/biodiversidade/fauna-brasileira/planos-de-acao/3618-plano-de-acao-nacional-para-a-conservacao-das-aves-do-cerrado-e-pantanal.html](http://www.icmbio.gov.br/portal/biodiversidade/fauna-brasileira/planos-de-acao/3618-plano-de-acao-nacional-para-a-conservacao-das-aves-do-cerrado-e-pantanal.html)).

The only previous record in the state is apparently that listed by Lopes *et al.* (2010) from 'Pará, Rio Cuminá, afluyente do Rio Trombetas' citing a rather ambiguous text in Miranda-Ribeiro (1937). However, the undated label on the specimen (MNRJ 16.302) reads 'Rio Trombetas, Cuminá, Mato Grosso. col. Rondon' (G. R. Brito *in litt.* 2014), presumably in error, but some doubt remains over its provenance. We consider ours to be the first unambiguous records for the state of Pará and certainly the first south of the Amazon. Elsewhere in southern Brazilian Amazonia the species has been recorded at several localities in south-west Mato Grosso, e.g. the Chapada dos Parecis (LACM 46320), Serra do Roncador (Fry 1970), Morrinho Lyra (Naumburg 1930), Vila Bela da Santíssima Trindade (Lopes *et al.* 2010) and Serra das Araras (Silva *et al.* 1988), as well as in neighbouring Rondônia at the Campo dos Palmares, headwaters of the rio Javari, Chapada dos Parecis (Miranda-Ribeiro



1937), at the Fragmento RO-7, Pimenta Bueno, and Fragmento RO-1, Vilhena (Roma 2006 *in* Lopes *et al.* 2010) and at Humaitá, Amazonas, where D. C. Pimentel collected one (MPEG 49443) on the BR-230, km 8, on 17 October 1991, and A. Whittaker (*in litt.* 2014) discovered a nest with two eggs on 13 January 2011.

#### **PLAIN-BREASTED GROUND DOVE** *Columbina minuta*

Our only confirmed record involved a pair photographed in a recently planted oil palm plantation at Fazenda Recanto (02°53'S, 49°11'W) in the municipality of Moju on 25 September 2013 (WA1175343, WA1170904). This represents only the second record from the Belém Area of Endemism, after a series of five individuals (FMNH 411441–445) collected on the rio Acará at Tomé-Açu between 4 and 23 December 1933. Elsewhere in south-east Pará, the species is known from a male (MPEG 14108) collected by J. Hidasi on the rio Fresco (a right-bank tributary of the rio Xingu) at Gorotire (07°46'S, 51°07'W) on 7 September 1957, and two recent photographic records from the middle Xingu at Senador José Porfírio (C. V. Mendonça: WA990130) and Vitória do Xingu (A. E. Rupp: WA920294), as well as the Santarém region (Lees *et al.* 2013). Aleixo *et al.* (2012) listed the species from the Floresta Nacional de Carajás based on a single undocumented record so its presence there should be considered hypothetical (A. Aleixo *in litt.* 2014).

#### **LEAST NIGHTHAWK** *Chordeiles pusillus*

Common in grassy *campinas* around Moju, for example >15 individuals at dawn on 12 September 2013 at 'Moju 2' (WA1108262) and six on the left bank of the Tocantins at Cametá on 3 October 2013 (e.g. XC150403). In Amazonia, the species is restricted to open-vegetation enclaves (savannas and *campinas*), such as in Amapá (Silva *et al.* 1997), Rupununi, Guyana / Roraima (Robbins *et al.* 2004, Santos & Silva 2007), Jaú National Park (Borges *et al.* 2001) and the upper rio Marmelos, Amazonas (Aleixo & Poletto 2007), and the Sipaliwini Savanna, Surinam (O'Shea 2005, Mittermeier *et al.* 2010). The nearest documented record concerns one collected (AMNH 430372) at Baião, on the rio Tocantins, on 1 December 1931 by A. M. Ollala.

#### **RUSTY-BACKED ANTWREN** *Formicivora rufa*

We first found this species in a *campina* planted with oil palms at 'Moju 1' on 11 September 2013 (WA1088763) and subsequently in all suitable *campina* habitats in the same municipality and adjacent Tailândia. We also found it in savannas either side of the Tocantins in the municipality of Cametá (e.g. Fig. 3a; WA1108187). It is present in most *campina* enclaves in Amazonia but has been reported from the Belém Area of Endemism only once before, along the rio Acará, where H. Meerwarth collected one in December 1898 (MPEG 1665). Although details are vague, this is conceivably close to the *campina* formations we sampled around Moju. However, there are more historic records from the west bank of the rio Tocantins, e.g. three specimens (MPEG 11991–11993) taken by F. Lima at the Campo de Pacurijó, Cametá on 3 and 22 February 1916. We anticipate that it will prove to be considerably more widespread than these scant records suggest.

#### **RUFIOUS-SIDED PYGMY TYRANT** *Euscarthmus rufomarginatus*

During point counts at dawn in an open *campina* physiognomy at 'Moju 2', on 12 September 2013, ACL heard the distinctive song of a pair of Rufous-sided Pygmy Tyrants and obtained some distant photographs. ACL & NGM returned the following day, securing better-quality images (e.g. Fig. 3b; WA1088760) and sound-recordings after playback (e.g. XC150393) of presumably the same pair c.200 m from their position of the day before. ACL & NGM

located another territory at a different *campina* 12 km west-northwest of 'Moju 1' on 14 September 2013. We conducted playback in several arborescent *campinas* on both banks of the Tocantins in the municipality of Cametá, but did not find the species there, although we infer its potential presence given the availability of *campina* of the same physiognomy as our records at Moju and the difficulty of finding this low-density species. Our records represent the fourth locality in the state of Pará. Previous records are from the Serra do Cachimbo on the border with Mato Grosso (Pinto & Camargo 1957, Santos *et al.* 2011), Campos do Rio Vermelho (07°39'S, 51°37'W) in the Terra Indígena Kaiapó (Whitney & Pacheco 1996; B. M. Whitney *in litt.* 2013) and nearby at the Aldeia Kuben-Kran-Krên (08°08'S, 52°07'W) on 24–30 April 2008 (A. Whittaker *in litt.* 2014). Elsewhere in Amazonia the species is known from three other *campina* enclaves: the Sipaliwini Savanna in southern Surinam (Mees 1968, Mittermeier *et al.* 2010), 48 km north of Macapá, Amapá, Brazil (Silva *et al.* 1997) and at Manicoré, Fazenda Bela Vista, Amazonas, at 08°31'S, 61°24'W (MPEG 57705; Aleixo & Poletto 2007). The closest-known localities are, however, in the Cerrado biome south-west of the region. T. Dornas photographed (WA456401) one along the TO-134 highway in the municipality of Darcinópolis, Tocantins, in Cerrado *sensu strictu* on sandy soils, on 17 May 2009, although this area has subsequently been converted to a *Eucalyptus* plantation. The species has declined across most of its range due to the loss of well-preserved Cerrado (Parker & Willis 1997) and is currently considered Near Threatened globally (Birdlife International 2014).

#### GREY MONJITA *Xolmis cinereus*

Fairly common in savannas on the west bank of the Tocantins at Cametá (Fig. 1; Cametá 1 and 2) between 2 and 4 October 2013 (e.g. Fig. 3c; WA1112847, XC150402). We did not encounter the species in the smaller enclaves around Moju and are reasonably confident that it does not occur there, but we did not spend significant time surveying arborescent *campina* on the east bank of the Tocantins, and given the similar habitat there and on the west bank, we anticipate its potential presence there. It is surprising that this large and conspicuous passerine was not reported by E. Snethlage, S. Klages or the Olalla brothers, all of whom collected along the lower Tocantins, raising the possibility that this region may have been only recently colonised or re-colonised by the species. These are the first published reports from the lower Tocantins, although it occurs 475 km to the south around Canaã dos Carajás (Aleixo *et al.* 2012; J. G. Vilar: WA1005020) and 80 km to the north-east on Marajó Island (Henriques & Oren 1997). There is a single record from Belém at the Federal University campus in 1984, which was considered by Silva & Oren (1986) to be a vagrant from Marajó. Our discovery along the lower Tocantins raises the possibility of an alternative origin for the Belém vagrant and hints at occasional inter-enclave movements by these open-habitat specialists in Amazonia.

#### CINNAMON TANAGER *Schistochlamys ruficapillus*

We recorded this species at two different *campinas* in the municipality of Moju; one seen briefly on 11 September 2013 at 'Moju 1' and next day a pair was photographed at 'Moju 2' (Fig. 3d; WA1088770). These records represent a range extension 180 km north-east of the species' previous northernmost outpost at Tucuruí, Pará, where five specimens (MPEG 34351–355) were collected by D. C. Oren on 9–14 June 1980. Elsewhere in the state, away from the Serra do Cachimbo (e.g. Santos *et al.* 2011; WA348952), J. Hidasi collected one (MPEG 15032) on the rio Tapajós at Itaituba, on 11 November 1955, and another on the upper rio Cururu, a right-bank tributary of the rio Tapajós (MPEG 23144) in June 1958.



**PLUMBEOUS SEEDEATER** *Sporophila plumbea*

Common in both *campinas* and degraded pastures around Moju (e.g. WA1240426) principally on land owned by oil palm companies, whose patrols apparently deter the presence of the ubiquitous bird trappers (A. P. Brito & P. Zanutto pers. comm.). There are relatively few records from savanna enclaves in Amazonia, although the species has previously been reported from the Agropalma Group Forest reserves by Portes *et al.* (2011) and occurs on Marajó Island (Henriques & Oren 1997; WA520959), at Aldeia Kuben-Kran-Krên (A. Whittaker *in litt.* 2014) and the Serra do Cachimbo (Pinto & Camargo 1957).

## Discussion

Our field work produced several significant range extensions for savanna species along the lower Tocantins, which is extremely surprising given proximity to the state capital and the 200-year history of ornithological research in the region (Moura *et al.* 2014). Our inventory should be considered extremely preliminary given that huge areas of unsurveyed *campinas* are present in the region, and we anticipate significant ornithological discoveries in such habitats in the future. For example, we searched extensively for Eastern Meadowlark *Sturnella magna* in *campinas* on both sides of the Tocantins, but only encountered small numbers of Red-breasted Blackbirds *S. militaris*. However, there are at least two historical records from the region: two collected by F. Lima on the west bank at Cametá in 1916, one at Fazenda Vaicajó (02°15'S, 49°29'W) on 3 February (ZMB 31289) and the other at Campo de Pacurijó (02°25'S, 49°5'W) on 22 February (held at MNRJ). There are also relatively extensive tracts of unsurveyed transitional forest in the region that may also yield significant ornithological surprises. For example, we (ACL, NGM & I. Thompson) recently visited tall *terra firme* forest 100 km south of Tailândia at Goianésia do Pará where we encountered an undescribed *Myiornis* pygmy tyrant (ACL: XC155227) recently collected in Maranhão and Piauí (C. Albano & L. Lima *in litt.* 2013) and an adult Black-faced Hawk *Leucopternis melanops* (ACL: WA1162085, XC155500). The latter is only the second record for the Belém Area of Endemism following one (MZUSP 43863) collected on the rio Capim, on the BR-14 highway, km 93, on 2 October 1959 (Amaral *et al.* 2007).

**Threats to savanna enclaves on the lower Tocantins.**—Savanna enclaves contribute significantly to regional betadiversity in Amazonia and support species of conservation concern whose habitats are under increasing pressure outside the biome, e.g. Rufous-sided Pygmy Tyrant (Klink & Machado 2005, Aleixo & Poletto 2007). *Campinas* along the lower Tocantins are under threat from aggregate extractors, agricultural and biofuel expansion, fire and drainage (Fig. 2c–d; Ferreira *et al.* 2013a,b). These habitats are poorly represented under the current Amazonian protected area network, with the nearest units being the Reserva Extrativista Arióca-Pruanã (59,600 ha) and Terra Indígena Anambé (21,700 ha), neither of which protects open-habitat physiognomies. We echo the pleas of Ferreira *et al.* (2010, 2013b) to create new protected areas to safeguard the region's biodiversity under the auspices of an Área de Relevante Interesse Ecológico (ARIE).

**Regional biogeographic implications.**—The question of how open-country bird species disperse through Amazonia to reach isolated open-habitat enclaves has vexed biogeographers for decades (Haffer 1967, 2001). Silva & Bates (2002) proposed three principal corridors that facilitated past connections between predominantly open habitats in central Brazil and Bolivia and northern South America: (1) an Andean corridor following the slopes of the Andes to the west of Amazonia; (2) a central Amazonian corridor via Monte Alegre and the Sipaliwini–Pará *campinas*; and (3) a corridor along the Atlantic coast north via *restinga* enclaves in north-east Pará, to Marajó Island and through the savannas of Amapá. Mittermeier *et al.* (2010) considered that the 'high number of CSA-unique [central

South American] species in Sipaliwini and Amapá, as opposed to Alter do Chão [near Santarém] supports the hypothesis that savanna connections within the southern block formed along the coast rather than across central Amazonia' citing Silva & Bates (2002). However, their comparison of lists relied on that compiled by Sanaïotti & Cintra (2001), which represented only a rapid inventory of Alter do Chão. An additional 33 open-country species have been reliably recorded there (Lees *et al.* 2013), 22 of which are shared between regions, seven are exclusively 'central' and four exclusively northern.

Our discoveries of open-habitat species along the lower Tocantins support another route, following enclave 'stepping stones' from the Cerrado in Tocantins north to Marajó Island, and highlight the difficulties of understanding the historic biogeography of Amazonia in the face of Wallacean shortfalls, in addition to the imminent threat that this unique avifaunal assemblages faces from land-use change and habitat degradation.

### Acknowledgements

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## Perplexing siskins: a review of the *Spinus pinus*–*S. atriceps* problem

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**SUMMARY.**—Black-capped Siskin *Spinus atriceps* and the southernmost form of Pine Siskin *S. pinus perplexus* have long been confused. We outline the taxonomic history of the complex and present a review of morphological characters based on the largest series yet assembled. Olive-morph birds are morphologically distinctive and are correctly associated with the name *atriceps*, although Salvin's original description also included a grey-morph specimen.

The highlands of southern Mexico and Guatemala (Fig. 1) form an area of endemism for birds (Peterson *et al.* 1998, Stattersfield *et al.* 1998, Watson & Peterson 1999), and two taxa of *Spinus* are confined to this region—Black-capped Siskin *Spinus atriceps* (Salvin, 1863) and Pine Siskin *S. pinus perplexus* van Rossem, 1938. Three plumage morphs have been variously associated with the two names: birds that are mainly olive, those that are mainly grey, and birds that are streaked brown and white (Fig. 2). Uncertainty concerning nomenclature and species limits in this complex has persisted for 150 years. Plumage variation in *S. atriceps* is poorly understood, and siskins from southern Mexico and Guatemala with mostly or partially grey plumage have sometimes (AOU 1983, Sibley & Monroe 1990) been regarded as hybrids with *Spinus pinus* (Wilson, 1810), following van Rossem (1938). We outline the taxonomic history of the complex and present a review of morphological characters in the available material of *S. atriceps* and *S. pinus*.

### Taxonomy and nomenclature of *Spinus atriceps*

O. Salvin described *Chrysomitris atriceps* (1863) from two specimens taken in August 1862 by R. Owen and himself in the highlands of western Guatemala near Quetzaltenango, dpto. Quetzaltenango, at an elevation of 8000 feet (14°50'40"N, 91°30'05"W; 2,440 m). Both possess a distinctive black crown. Although both are adult males, they otherwise differ strikingly in plumage. One (Natural History Museum, Tring, BMNH 1885.12.14.1179, Fig. 3a) is mostly olive-plumaged, the other (BMNH 1885.12.14.1180, Fig. 3b) is similarly patterned (including the blackish crown), but has a mostly grey head, underparts and mantle. The breast has some scattered olive feathers. Salvin's description begins: '*Olivacea; capitis lateribus griseis; abdomine medialiter cinereo; dorso postico et uropygio viridescenti-flavis; pileo toto et gula nigris, hac obscuriore...*', which we translate thus: 'Olivaceous; with sides of head grey; middle of belly ash-grey; back and rump are green-yellow; whole cap and throat black, of which [the throat is] darker...'. These characters match the grey and not the olive bird. Salvin (1863) added 'The two specimens from which the above description was taken differ considerably in colouration from one another, one being in old and somewhat worn plumage, the other more freshly moulted and brighter *olivaceous*' (our emphasis). In the *Biologia Centrali-Americana*, Salvin & Godman (1886: 429–430, for dating see Dickinson *et al.* 2011) repeated Salvin's Latin description, which they noted applied only to the grey specimen, whereas 'the other specimen is of a much more olive-colour above and below, this taking the place of the grey colouring of the under surface' (our emphasis). A colour plate illustrated the syntypes (Fig. 4). Thus, although Salvin (1863) did not designate a holotype

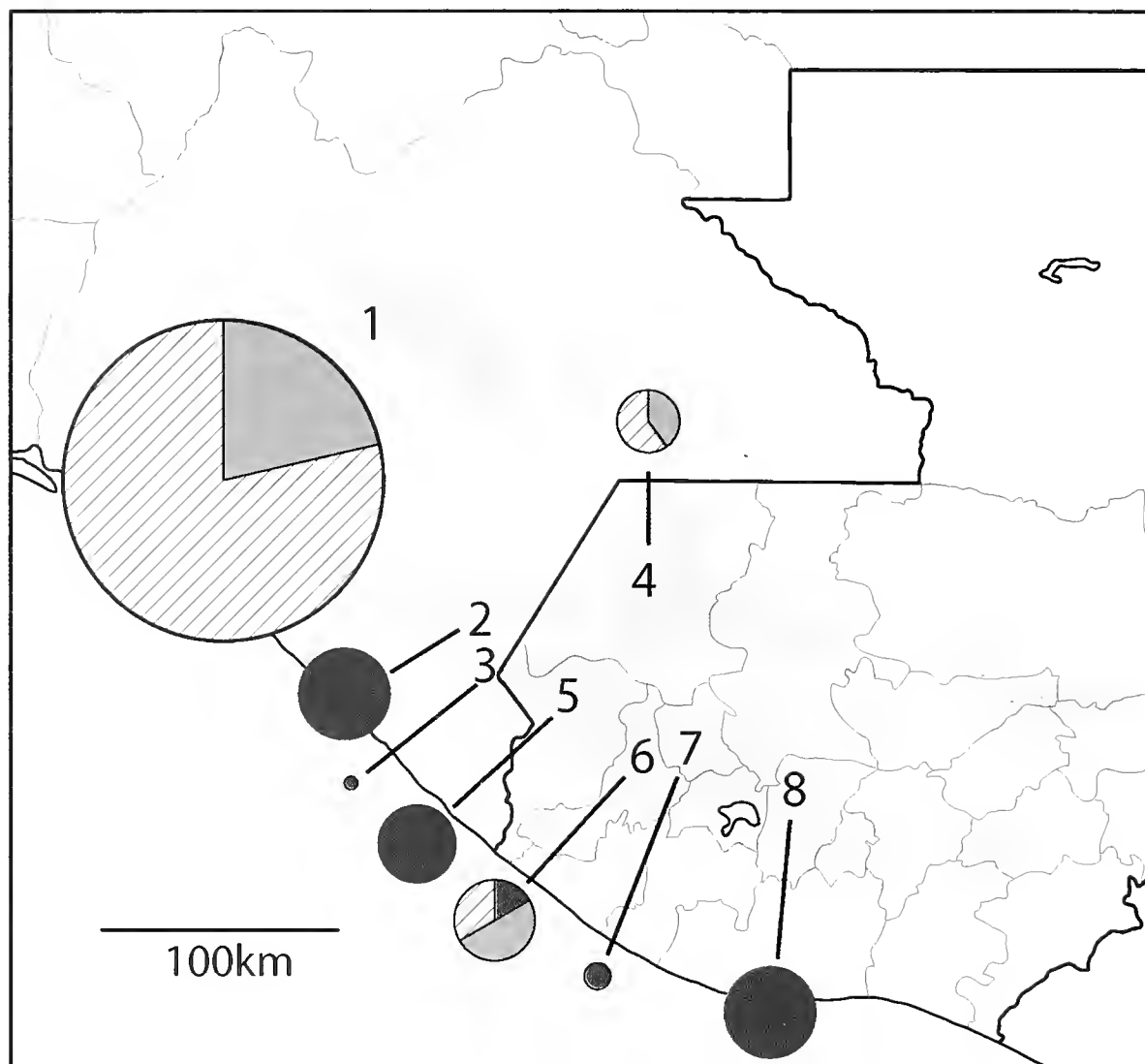


Figure 1. Map of southern Mexico (sites 1–3) and western Guatemala (4–8) showing collecting localities and distributions of three morphotypes in the *Spinus atriceps* / *pinus perplexus* complex. Shaded areas = >2,000 m in elevation. Pie charts show distributions and co-occurrence of morphotypes; striped = streaked morph, grey = grey morph and olive = olive morph. Sizes of individual pie charts proportional to sample sizes at each site (1) San Cristóbal area,  $n = 28$ ; (2) southern highlands of Chiapas,  $n = 7$ ; (3) Tacana, Chiapas,  $n = 1$ ; (4) Chancol, dpto. Huehuetenango,  $n = 5$ ; (5) San Marcos, dpto. San Marcos,  $n = 6$ ; (6) Quetzaltenango, dpto. Quetzaltenango,  $n = 6$ ; (7) Desconsuelo, dpto. Totonicapán,  $n = 2$ ; (8) Tecpán, Chimaltenango,  $n = 7$ .

in present-day fashion (the two specimens are syntypes), he chose the grey-plumaged bird for his diagnosis, presumably because he believed it to be more fully adult.

Ridgway (1884) reached the opposite conclusion in determining the age of these specimens. He examined the syntypes of *C. atriceps* and noted the variable colour of the underparts describing them as 'yellowish olive (in some specimens dull greyish).' Later, in his account for *S. atriceps* in *The birds of North and Middle America* (Ridgway 1901), he compared them with two additional specimens in the United States National Museum, Washington DC. Presumably, these are the birds taken on 9 January 1896 at Hacienda Chancol, dpto. Huehuetenango, Guatemala (USNM 143725) and 24 September 1895, at San Cristóbal, Chiapas, Mexico (USNM 143724). Ridgway determined the olive syntype to be an adult male and tentatively regarded the grey syntype as an 'immature male (?)' He considered one of the birds (USNM 143725), also grey, to be an 'immature (?) male' of *C. atriceps* and an unsexed bird (USNM 143724) to be an 'immature (?) male' *C. atriceps*.

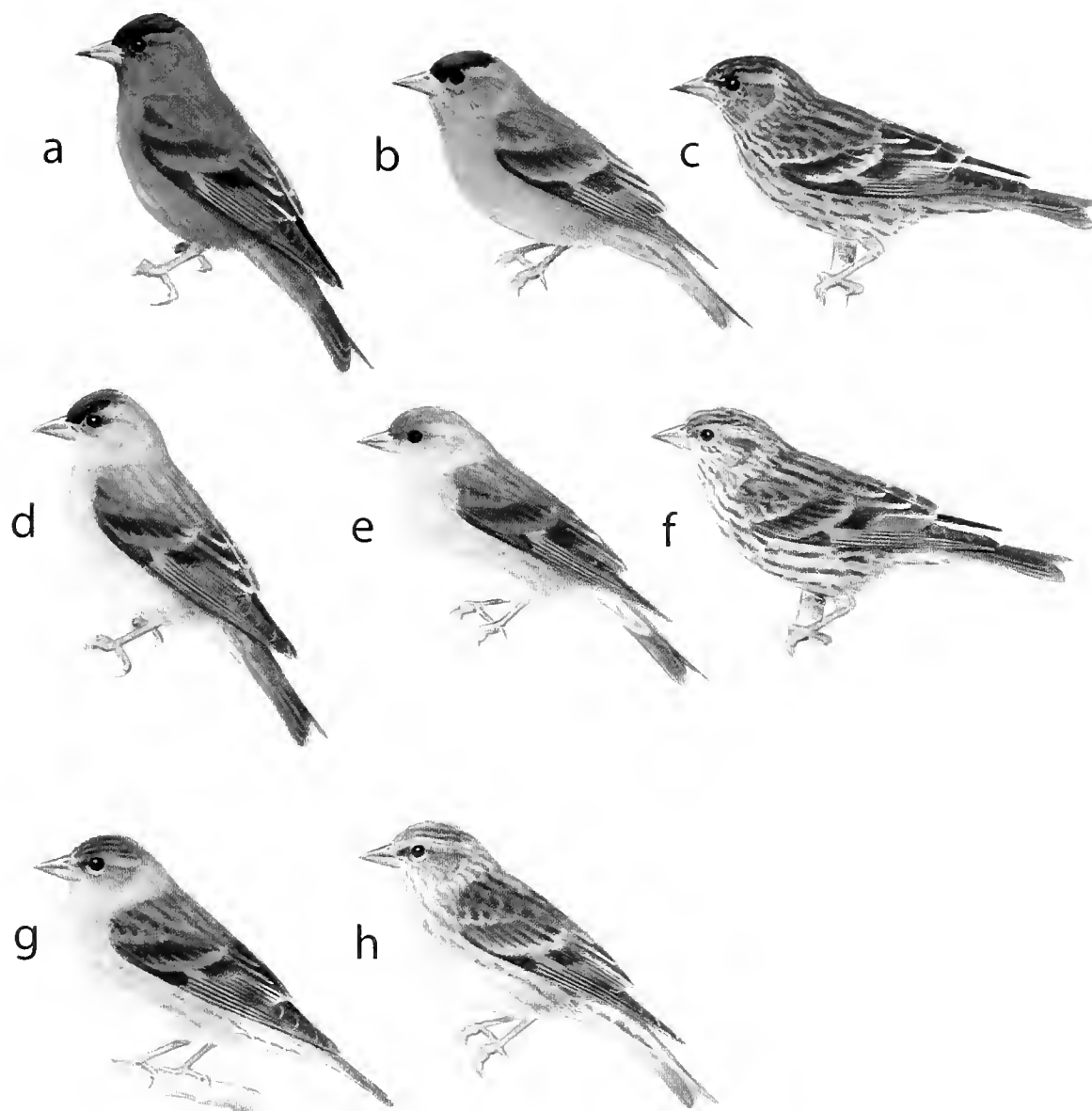


Figure 2. Plumage morphotypes in the *Spinus atriceps* / *pinus perplexus* complex: (a) olive morph typical adult male, (b) olive morph typical adult female, (c) olive morph juvenile, (d) grey morph typical adult male, (e) grey morph typical adult female, (f) unknown juvenile, (g) streaked morph adult, greyish extreme, (h) typical streaked morph adult (Dale Dyer)

### Taxonomy and nomenclature of *Spinus pinus perplexus*

In 1933 and 1938, A. J. van Rossem examined material in the British Museum (Natural History) (BMNH), with the aim of identifying and segregating types of American birds, during which work he described no fewer than 21 new subspecies of birds from Mexico and Guatemala (van Rossem 1938, see Miller 1957, Warren 1966: iv), among them *S. pinus perplexus*. For the type, van Rossem designated a brownish, streaked, adult female (BMNH 1899.2.1.2116) collected by W. B. Richardson at San Andrés, Chiapas, Mexico (16°53'01"N, 92°42'48"W) on 11 May 1897. His description reads: 'Differs from *Spinus pinus pinus* (Wilson) of North America and *Spinus pinus macropterus* (Du Bus) of Mexico in more slaty (less brownish) and slightly darker dorsal coloration and more obsoletely streaked underparts; size slightly smaller than *S. p. pinus* and decidedly smaller than *S. p.*

*macropterus*.' The holotype (Fig. 3c) is similar to many northern specimens of *S. pinus* but is generally greyer, with the streaking on the underparts and mantle somewhat less distinct and less contrasting.

By the time of van Rossem's visits, the BMNH series included Salvin's types of *S. atriceps* and an additional 18 specimens collected by W. B. Richardson in 1890 and 1897, in the highlands of southern Mexico (Chiapas) and western Guatemala. The Richardson material includes siskins with a range of plumage characters including mostly olive specimens with black caps and yellow bellies (Fig. 2a), mostly grey birds with blackish caps and white bellies (Fig. 2d), mostly grey birds with concolorous grey caps, and streaked brown-and-white birds that resemble northern examples of widespread *S. pinus* (Fig. 2g–h). Van Rossem regarded the mostly olive, black-capped plumage (including the olive syntype of *C. atriceps*, BMNH 1885.12.14.1179) as adults of *S. atriceps*, but the grey-plumaged birds (including Salvin's grey syntype) as 'intermixtures' with *S. pinus*. His description lists six specimens as *S. p. perplexus*, and seven grey birds as 'intermixtures' between *S. pinus perplexus* and *S. atriceps*. Van Rossem (1938) stressed the significance of bill morphology as a diagnostic character, noting that the bill of *S. atriceps* is longer and more slender than that of *S. p. perplexus*, and remarking 'were it not for the very differently shaped bills it might be argued that one dimorphic species was present.' He added that 'these species give every evidence of undergoing complete amalgamation.' In a cryptic remark he hinted that 'the situation ... is too involved to be discussed here in full', but he did not revisit the issue subsequently.

Confusion surrounding the taxonomy of the grey birds is reflected in the Nelson & Goldman series (USNM 143723–725) being relabeled *Carduelis pinus perplexa* by P. Brodkorb, in newly collected grey birds determined as *S. p. perplexus* by R. T. Moore (Moore Zoological Laboratory, MZL 57023), two specimens identified as '*atriceps*' by A. R. Phillips (Delaware Museum, DMNH 34695, 34696), and a specimen with the label annotated 'hybrid' in the Louisiana State University Museum of Zoology, Baton Rouge (LSUMZ 49577). More recently, Arnaiz-Villena *et al.* (2007, 2008) presented a study of New World *Spinus* siskins based on mtDNA. These included blood samples from single individuals identified as *S. p. perplexus* and *S. atriceps* trapped in dpto. Quetzaltenango, Guatemala. No vouchers were preserved by those workers. Photographs in their publications show a siskin with boldly streaked underparts labeled *S. p. perplexus*, and a grey-plumaged bird with black cap labeled *S. atriceps*.

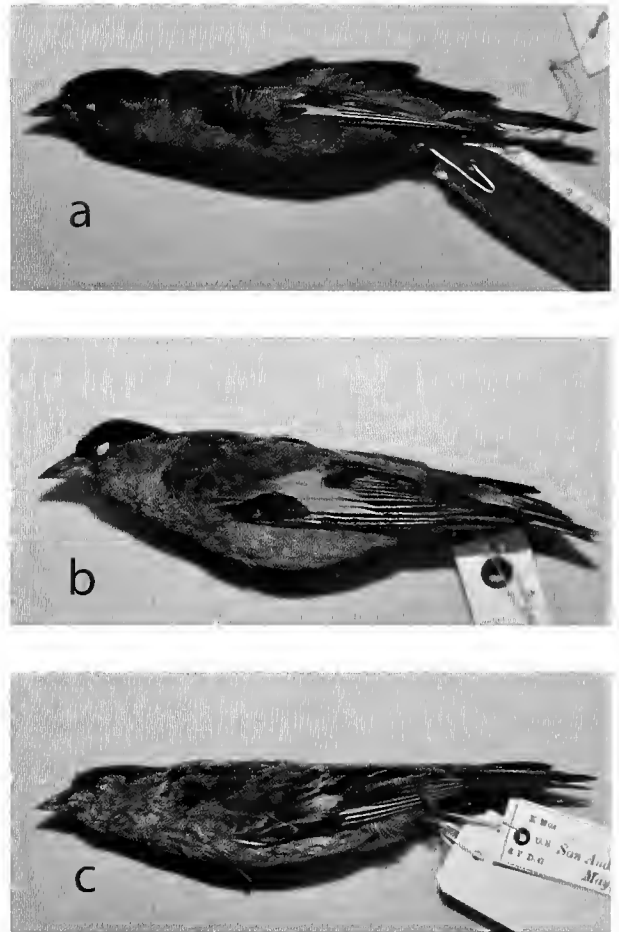


Figure 3. Type specimens in the *Spinus atriceps* / *pinus perplexus* complex: (a) olive syntype of *Spinus atriceps* (Salvin, 1863), BMNH 1885.12.14.1179, (b) grey syntype of *Spinus atriceps* (Salvin, 1863), BMNH 1885.12.14.1180, (c) holotype of *Spinus pinus perplexus* van Rossem, 1938, BMNH 1899.2.1.2116 (Tom Trombone / © Natural History Museum, London)



## Materials and Methods

We searched museum collection databases to compile a database of specimens catalogued either as *S. p. perplexus*, as *S. atriceps*, or as hybrids of *S. pinus* and *S. atriceps* (Appendix 1). We sorted specimens into three morphotypes and examined specimens and photographs for indications of plumage wear and moult to determine age (juvenile or adult). Where possible we obtained measurements of bill depth, bill length (nostrils to tip) and wing chord. We excluded immatures and birds in primary moult from our morphometric analysis. We used principal component analysis (PCA) to reduce the dimensionality and complexity of the morphometric data. A PCA based on the correlation matrix of three traits (bill length, bill depth and wing chord) was used to derive allometric size and shape variables (*cf.* Perktas & Gosler 2010, Perktas 2011). PCA derived three principal components. Because PC1 explained most of the variance among individuals (Table 1), we used individual PC1 scores for further statistical analyses. Before analysing individual PC1 scores, we tested normality and homogeneity of variances using the Kolmogorov-Smirnov test ( $Z = 0.524$ ,  $p > 0.05$ ) and Levene statistics ( $Levene\ statistic_{2,26} = 0.471$ ,  $p > 0.05$ ) respectively. We then used one-way ANOVA to reflect shape differences among the three morphotypes. Hochberg's GT2 method (for unequal sample sizes, Quinn & Keough 2002) was used for multiple comparisons.

## Results

We located 74 specimens from Chiapas, Mexico or Guatemala that have been catalogued as *S. p. perplexus*, as *S. atriceps*, or as hybrid *S. pinus* × *S. atriceps*. We personally examined 45 of these specimens, and reviewed photographs of an additional 21 (Appendix 1). We sorted specimens ( $n = 66$ ) into three morphotypes (Fig. 2). Notations in parentheses following colour names refer to Ridgway (1912).

The primaries, secondaries and rectrices of all three morphotypes are similarly coloured, being mostly blackish brown (21''m). The outer web of each primary is finely edged yellow (23b) to the emargination. The base of each primary, excepting the outer two or three, are yellow. The bases of the secondaries are also yellow and the secondaries are fringed yellow from the tip to a point short of the yellow basal patch. On the folded wing the yellow bases of the remiges are mostly or completely covered by the wing-coverts and there is a dark band between the panel of yellow fringes on the secondaries and coverts. The rectrices are yellow at the base of the inner web on all but the central feathers. Yellow extends to the outer web at the base of the outermost feathers.

**Olive morphotype.**—Adults ( $n = 19$ ) are mostly uniform in coloration though some individual variation is evident. All olive-morph adults have a black cap. In most specimens ( $n = 11$ ) the remaining upperparts are dark olive (23''k), except the rump, which is olive (23''). The throat, and in some examples, the fore cheeks, are blackish. Otherwise the face, breast and flanks are olive (23''). The central belly and undertail-coverts are pale yellow (23'b). The undertail-coverts are streaked brown. The wing-coverts are blackish brown (21''m) basally and broadly tipped yellow-olive (23). Yellow-olive extends over half of the greater coverts and most (or all) of the median and lesser coverts. The tertials are blackish brown fringed laterally with yellow-olive (23) and have whitish tips (Fig. 2a). Some adults ( $n = 8$ ) including most females and one male are an overall greyer shade of olive, and the yellow underparts may be paler. These also lack any black on the throat (Fig. 2b).

Olive-morph juveniles ( $n = 2$ ) are streaked very dark brown (21''m) and pale brown (21''b) above, the cap sometimes being almost uniformly dark. The rump may be paler, and more yellow, approaching yellow-olive (23''b). The face, breast and flanks are yellowish

white with dark brown (21'''k) streaks with a distinctive wedge, or chevron, shape. The wing-coverts and tertials are tipped yellowish white (Fig. 2c). Three specimens (AMNH 30976, WFMV 14541, 14543) show varying extents of streaked plumage and patches of plain olive, thereby demonstrating the progression between juvenile and adult plumage in this morphotype.

Olive-morph birds are known only from Guatemala and the southern Chiapas highlands. Guatemalan specimens are available from Tecpam [=Tecpán] dpto. Chimaltenango ( $n = 7$ ), Quetzaltenango, dpto. Quetzaltenango, ( $n = 1$ ), San Marcos, dpto. San Marcos ( $n = 6$ ), and Desconsuelo, dpto. Totonicapán ( $n = 2$ ). Mexican specimens are from Cerro Male, Chiapas ( $n = 7$ ) and Volcán Tacana, Chiapas ( $n = 1$ ). This form is unknown from the San Cristóbal region of central Chiapas, Mexico, and we have not seen specimens of this morph from dpto. Huehuetenango, Guatemala (Fig. 1).

**Grey morphotype.**—Adults ( $n = 11$ ) are rather uniform except in crown colour, which may correlate to sex. Adult males ( $n = 9$ ) have a blackish cap that is not as black as in olive birds, and in one example breaks into spots at the rear. Most of the remaining upperparts, including the crown of cap-less birds ( $n = 2$ ), are dark grey (21'''), with faint browner streaks, sometimes mixed with olive on the lower back. The rump is dusky yellow (23''b; i.e. paler than the olive rump of olive-morph birds). Some males have a faint blackish smudge on the throat. Otherwise the face, breast and flanks are neutral grey (23'''d), sometimes with very faint brownish flanks streaking. The belly and undertail-coverts are white, the latter streaked brown. The wing-coverts are blackish brown basally and broadly tipped yellow-olive (23). Yellow-olive extends over half of the greater coverts and most (or all) of the median and lesser coverts. The tertials are blackish brown fringed laterally with yellow-olive and have whitish tips (Fig. 2d–e). Juvenile plumage is unknown.

Grey morphs have been collected in dpto. Quetzaltenango, Guatemala ( $n = 3$ ), Chancol, dpto. Huehuetenango, Guatemala ( $n = 2$ ), and in the San Cristóbal region of central Chiapas, Mexico ( $n = 6$ ).

**Streaked morphotype.**—This form includes the holotype and type series of *S. pinus perplexus* and is the most variable morphotype. It is streaked very dark brown (21'''b) and pale brown (21'''m) from crown to lower back. Overall coloration is variable, but is always greyer (less warm or brownish) than other forms of *S. pinus*. Streaked-morph birds are also usually darker overall than in other forms of *S. pinus*, including on the crown. The streaking varies from soft to moderately crisp, but is usually less contrasting and well defined than in other forms of *S. pinus*. The rump varies from pale beige (21'''d / 17'''d) to concolorous with the mantle, or from very pale yellow to dusky yellow, and usually shows some streaking. The face, breast and flanks vary from streaked pale greyish brown (21'''b) and whitish, to broad, soft, brownish-grey streaking with the white markings narrower, yielding a more muted, uniform appearance. The belly and vent are whitish, or yellowish white in two juveniles, and the undertail-coverts are streaked brown. Wing-coverts are narrowly tipped whitish, beige or olive-beige, and may show narrow yellowish lateral fringes to the greater coverts. The tertials are narrowly fringed whitish or yellowish and tipped whitish (Fig. 2g, h). Some streaked birds with juvenile rectrices are similar in plumage to adults.

Streaked-morph birds have been collected at Quetzaltenango ( $n = 2$ ), Chancol, dpto. Huehuetenango, Guatemala ( $n = 3$ ) and in the San Cristóbal region of central Chiapas, Mexico ( $n = 22$ ).

We examined two additional juveniles that we cannot confidently assign to any of the three morphotypes (Fig. 2f). Both are boldly streaked brown below. The wing-coverts in these specimens are tipped cinnamon (17'''b) as in juvenile *S. p. pinus*. Two additional specimens may represent either this plumage or be juveniles of the olive morph (Fig. 2c).



Figure 4. Illustration of *Spinus atriceps* from Salvin & Godman (1886)

### Morphometric analysis

PC1 explained most of the variance among individuals (Table 1). PC1 had relatively high positive factor loading for bill length (nostril to tip), and negative factor loadings for wing length and bill depth. Hence, PC1 was taken to be a measure of bill shape, whereby specimens with higher PC1 scores have a longer and more slender bill and relatively shorter wing length. ANOVA detected a significant difference in PC1 scores among morphotypes ( $F_{2,28} = 10.978$ ,  $p < 0.001$ ). Multiple comparisons revealed that both sexes of the olive morphotype had longer and more slender bills, and relatively shorter wing length in comparison to both the grey and streaked morphotypes (Fig. 5).

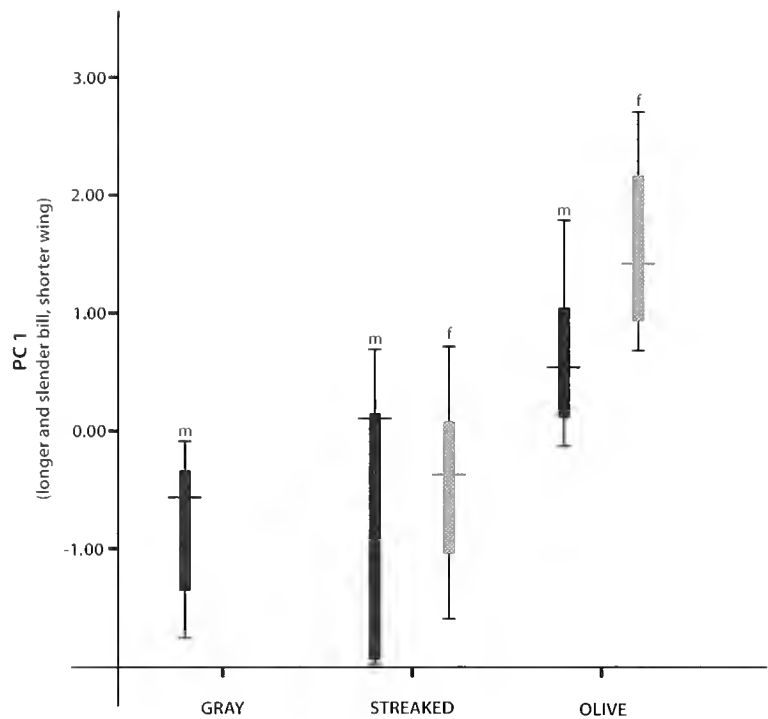


Figure 5. Variation in PC1 among morphotypes in the *Spinus atriceps* / *S. pinus perplexus* complex. Olive-morph birds differ significantly from grey and streaked morphotypes: mean difference = -1.794,  $p = 0.003$ ; between streaked and olive morphotypes: mean difference = -1.476,  $p = 0.001$ )

Discussion

Plumage maturation and hybridisation have been advanced to explain variation in this complex (Ridgway 1901, Salvin & Godman 1886). Specimens in moult from a streaked juvenile to plain olive plumage (see above) demonstrate, however, that grey plumage does not represent a stage in the olive bird’s maturation. While all juvenile siskins that we examined are streaked, many streaked birds have adult-shaped rectrices and some bear labels indicating gonads in breeding condition. Also, all grey-morph birds examined are at least post-juvenile. Plumage maturation is thus eliminated as an explanation for the olive and grey morphs.

Van Rossem’s (1938) suggestion that variation in this complex is evidence of hybridisation must be reassessed in light of the larger series assembled for this study. The grey morphotype, including those birds regarded by van Rossem as ‘intergrades’ or ‘intermixtures’ are, in colour, unlike either of the supposed parent forms, and do not appear to present an intermediate character state. However, some grey-morph birds possess a limited number of olive feathers, usually on the mantle and sometimes the underparts (i.e. the grey syntype of *S. atriceps*). Grey-morph birds can also exhibit limited faint brownish flanks streaking. Birds of the streaked morph can be clearly streaked brown on white,

TABLE 1  
Principal component loadings from analysis of three morphological traits in *Spinus pinus* / *S. atriceps* specimens ( $n = 29$ ).

Variables	Factor loadings		
	PC1	PC2	PC3
Wing chord	-0.667	-0.512	0.540
Bill length (nostril to tip)	0.732	0.137	0.668
Bill depth	-0.552	0.801	0.232
Variance explained (%)	42.9	30.8	26.3

TABLE 2  
Summary of morphological characters in the *Spinus pinus perplexus* / *S. atriceps* complex (adults).  
Measurements (mm) made with dial callipers. Range (mean).

	olive morph	grey morph	streaked morph
cap	black	black in all known males, known females grey streaked brown	streaked light / dark brown
back	dark olive	grey or olive-grey, streaked brown	streaked light / dark brown
rump	yellow-olive	yellowish grey	paler and more softly streaked than back, sometimes yellowish
throat, face	blackish or olive throat, olive face	blackish or grey throat, ash-grey face	softly streaked pale brown or grey-brown on whitish ground colour
breast, flanks	olive	ashy grey	softly streaked pale brown or grey-brown on whitish ground colour
belly, undertail-coverts	yellow, undertail-coverts streaked dark	white, undertail-coverts streaked dark	white, undertail-coverts streaked dark
tertials	blackish, with broad olive or yellowish lateral fringes, whitish tips	blackish, with broad olive or yellowish lateral fringes, whitish tips	blackish, with yellowish-white lateral fringes, white tips
greater wing-coverts	blackish, broadly tipped olive	blackish, broadly tipped olive	blackish, tipped whitish or yellowish white, some with yellowish lateral fringes
median wing-coverts	broad olive tips	broad olive tips	tipped whitish, beige or olive-beige
wing chord	66–71 (69) <i>n</i> = 11	69–73 (71) <i>n</i> = 7	67–72 (69) <i>n</i> = 15
bill length (nostril to tip)	8.5–9.5 (9.1) <i>n</i> = 11	8.1–9.0 (8.4) <i>n</i> = 7	7.9–9.3 (8.5) <i>n</i> = 15
bill depth	5.4–6.1 (5.8) <i>n</i> = 9	5.8–6.1 (6) <i>n</i> = 5	5.7–6.4 (6.1) <i>n</i> = 12

but the streaking is sometimes broader, softer and / or greyer, and some examples of the streaked morph have underparts approaching typical grey-morph birds (Fig. 2g). Thus, although the grey morph does not seem intermediate between streaked and olive morphs, there is some approach between streaked and grey morphs, as well as between grey and olive morphs. The belly is yellow in adults of the olive morph and white in adults of both the grey and streaked morphs. The cap of grey birds is variable, being either not black like streaked birds, or black like olive birds, though rarely is it as black and as well defined. Thus cap coloration of grey birds exhibits a range of intermediate states. The wing-coverts of grey and olive birds are similar, with very broad olive tips. The wing-coverts of streaked birds are quite variable, often with narrow pale tips. However, these markings may be darker or more olive, and thus somewhat similar to, but still distinct from, the broad olive tips to the coverts of olive-morph and grey-morph birds. Table 2 presents a summary of plumage characters in the *S. pinus* / *S. atriceps* complex.

Our results confirm van Rossem’s (1938) suggestion that olive-morph birds are distinguished by their longer and more slender bills (Fig. 5, Table 2), but we found no significant difference between the bills of streaked-morph and grey-morph birds. Our sample may fail to present a complete representation of each morphotype’s geographic distribution, but we note that a series of 25 birds collected in central Chiapas includes three grey individuals and no olive birds (Fig. 1). Thus putative ‘hybrids’ are present where one of the ‘parent’ species may be absent. Grey morphs do not appear to present an intermediate

character state between the olive and streaked morphs. However, *S. p. perplexus* displays a range of characters intermediate between grey-morph birds and *S. p. macropterus*.

Polymorphism might also be considered, with grey birds representing a morph of either *S. pinus perplexus* or *S. atriceps*. Plumage polymorphism is evident in other carduelines (e.g. in Lesser Goldfinch *S. psaltria*, and in females and immatures of Andean *S. spinescens* and Hooded Siskins *S. magellanicus*: DD pers. obs.).

Recent genetic studies have revealed that the grey and streaked forms are closely related, and together form a separate lineage from the olive form (Mila *et al.* in prep.). Although neither syntype was sampled by that study, these results suggest that the grey and olive syntypes of *S. atriceps* may be representatives of different taxa. We recognise that van Rossem's use (1938: 135) of the phrase 'the type' in reference to a specimen that is demonstrably the olive syntype (BMNH 1885.12.14.1179) constitutes designation of an *S. atriceps* lectotype. Fig. 3a shows that BMNH 1885.12.14.1179 bears a red type label, and this specimen was listed in Warren & Harrison (1971) as a syntype. These authors added that the second syntype is also at BMNH, but they rarely listed lectotypes. While grey birds have lingered in nomenclatural confusion, olive-plumaged birds have always been associated with the name *atriceps* and this is reflected in many popular and systematic treatments (Ridgway 1901, van Rossem 1938, Blake 1953, Miller *et al.* 1957, Alvarez del Toro 1971, Davis 1972, Peterson & Chalif 1973, Land 1970, Howell & Webb 1995, Clement 2010). This designation maintains applicability of existing nomenclature and stability of usage. Against this, van Rossem's (1938) designation may yield the result that, should the olive and grey morphotypes prove not to be conspecific, Salvin's (1863) diagnosis of *atriceps* would present characters of a form that differs from modern interpretations of that taxon.

## Conclusions

Species limits in the *S. atriceps* / *S. pinus* complex remain poorly understood, and many authorities have followed van Rossem (1938) in suggesting that these forms hybridise and may be conspecific (e.g. Howell *et al.* 1968, AOU 1983, Sibley & Monroe 1990, Howell & Webb 1995, Clement 1993, 2010). The collection of additional vouchered, genetic material from the Chiapas and Guatemalan highlands is required to shed further light on the nature of plumage variation, species limits and perhaps phylogenetic relationships in the *S. pinus* / *S. atriceps* complex. Sound-recordings of vouchered specimens might also provide valuable data. Sampling, assembly and analysis of genetic data, together with data from the syntypes of *S. atriceps* and holotype of *S. pinus perplexus*, offer the best promise of lasting resolution.

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#### APPENDIX 1: Specimens examined.

Olive morphotype: AMNH 397802–808; USNM 349770–771; UMMZ 110328–329; WFMV 14540–543, 14548. From photographs: BMNH 1885.12.14.1179, 1899.2.1.575–580; KU 111825.

Grey morphotype: DMNH 34695–696; LSUMZ 49577; MLZ 57023; USNM 143723–725. From photographs: BMNH 1885.12.14.1180, 1899.2.1.581–584, 1899.2.1.587.

Streaked morphotype: DMNH 27315–318; LSUMZ 49581–582; MLZ 50012–014, 56848, 56892, 57018, 57024; USNM 194298–299; UMMZ 109557; WFMV 3449, 3165, 11326. From photographs: BMNH 1899.2.1.2115–2116, 1899.2.1.585–586, 1899.2.1.588, 1899.2.1.844.

Unidentified juveniles: USNM 143748–750. From photographs: BMNH 1899.2.1.845.

## McConnell's Flycatcher *Mionectes macconnelli* is more than one species

by Steven L. Hilty & David Ascanio

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**SUMMARY.**—Information on voice, display behaviour, elevational distribution and morphology of McConnell's Flycatcher *Mionectes macconnelli* indicate that the two northern populations, long regarded as a single species, actually comprise two species-level taxa—a widespread lowland form *macconnelli* and a highland form *roraimae*. The two forms are similar in plumage, but differ significantly in wing and tail length, and most importantly in vocalisations and display behaviour. They are separated by elevation, with *macconnelli* found in humid lowland forest up to c.500 m and *roraimae* usually well above 500 m. Another highland taxon, *mercedesfosteri*, differs little from *roraimae* and is not recognised here as distinct, although its voice is unknown. Two isolated populations, one in central Peru, the other in lowland Amazonia are not evaluated, but merit additional study.

During the past few decades a better understanding of mechanisms underpinning reproductive isolation has sparked a re-examination of species limits of many taxa. Avian vocalisations and habitat preferences, in particular, have been shown to be important isolating mechanisms (Zimmer 1997, Isler *et al.* 1999, Zimmer & Whittaker 2000, Whittaker 2002, Salaman *et al.* 2003, Braun *et al.* 2005). This paper documents an example of two morphologically similar forms, *Mionectes m. macconnelli* and *M. m. roraimae*, which we believe have achieved reproductive isolation through voice, behaviour and differences in elevational distribution.

McConnell's Flycatcher *Mionectes macconnelli* is a drab, mostly olive-plumaged Tyrannidae found east of the South American Andes. It was originally described as a subspecies of Ochre-bellied Flycatcher *M. oleagineus* from the Kamakabra River in present-day Guyana (Chubb 1919), and the specific name was incorrectly spelled because it was intended to honour F. V. McConnell. In the same paper, Chubb also described highland *roraimae* from nearby Cerro Roraima, but incorrectly regarded it as a subspecies of *M. oleagineus* as well. Todd (1921) recognised that *macconnelli* was widely sympatric with *oleagineus*, elevated *macconnelli* to species status and treated *roraimae* as a subspecies of *macconnelli*. In the same paper he described a third subspecies, *amazonus*, from the lowlands and foothills of south-eastern Peru and Bolivia. A fourth, *peruanus*, was described by Carriker (1930) from middle elevations on the east slope of the Andes in Junín, Peru. Much later a fifth, *mercedesfosteri*, was described as a subspecies endemic to Cerro de la Neblina on the Venezuela / Brazil border (Dickerman & Phelps 1987). Specimens from Cerro Duida also were assigned to this subspecies (initials R. W. D., NY, '85' on specimen labels). On re-examining all subspecies Fitzpatrick (2004) recognised only three of them, subsuming *mercedesfosteri* into *roraimae* and *amazonus* from Bolivia and southern Peru into nominate *macconnelli*.

Therefore, depending upon one's interpretation of the rather convoluted taxonomic history of *M. macconnelli*, it comprises two or possibly three subspecies in north-eastern South America and two isolated subspecies in south-western Amazonia. This paper discusses only nominate *macconnelli*, which occurs in the lowlands of extreme eastern



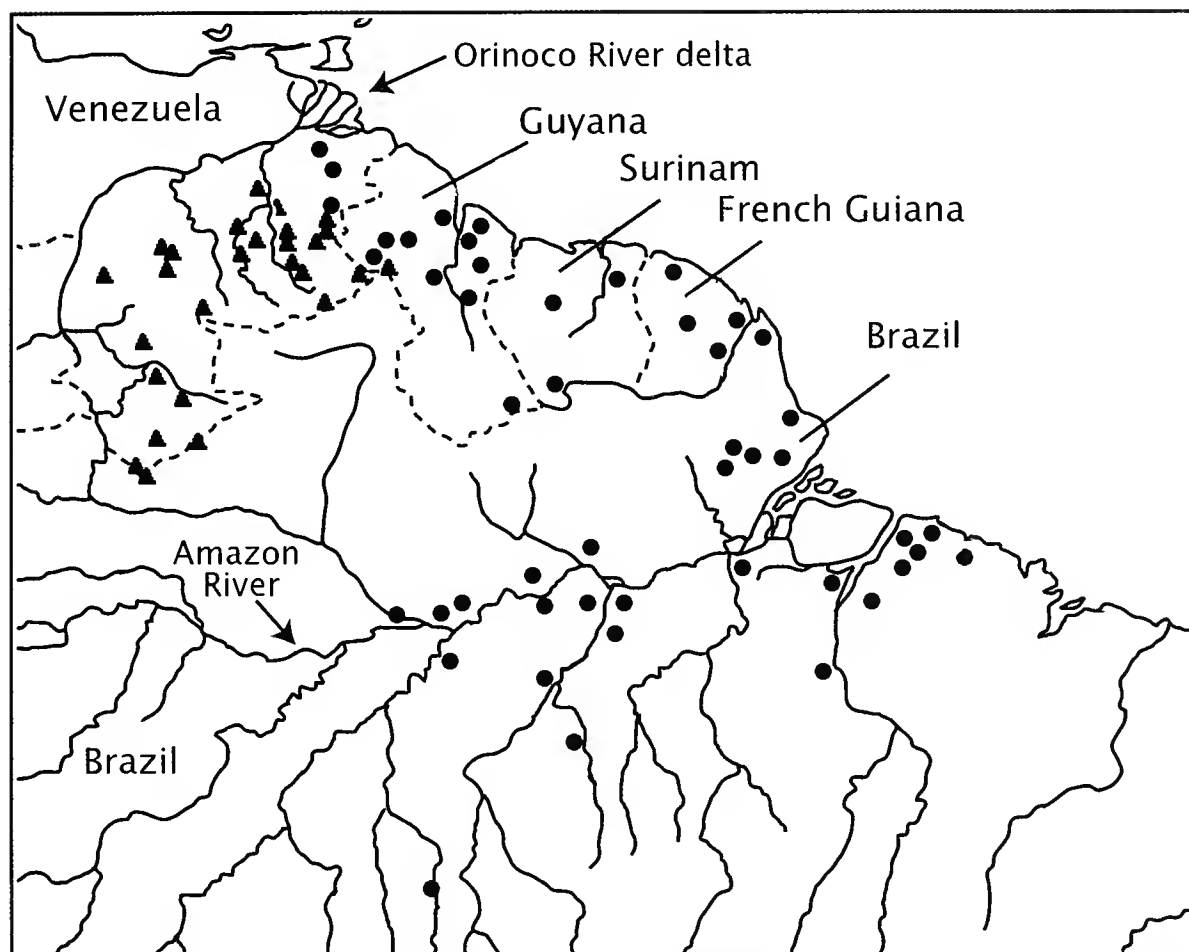


Figure 1. Map showing locality records for *Mionectes m. macconnelli* (solid circles) and *M. m. roraimae* (solid triangles).

Venezuela, the Guianas and the eastern half of Amazonian Brazil, and highland *roraimae*, which is found in the tepuis and río Caura watershed of south-eastern Venezuela and adjacent Guyana (Fig. 1), and has recently also been recorded in adjacent Brazil (M. Cohn-Haft & L. N. Naka pers. comm.).

*Mionectes macconnelli* is quite similar to allied *M. oleagineus* and Grey-hooded Flycatcher *M. rufiventris* (an Atlantic Forest endemic). All three species are characterised by brassy olive upperparts, mainly dull orange-ochraceous underparts and a narrow bill (Ridgely & Tudor 1994). All subspecies of *M. macconnelli* also are quite similar morphologically. *M. m. roraimae* was described by Chubb (1919) as differing from *macconnelli* in being 'rather smaller, paler on the upper-parts, and more brightly coloured on the abdomen, under tail-coverts, axillaries, and under wing-coverts.' Todd (1921) described *roraimae* as similar to *macconnelli*, but more richly coloured throughout, with the uppertail-coverts, throat and upper breast strongly shaded orange-citrine, and yellowish ochre on the lower underparts, axillaries and underwing-coverts, with the wings and tail edged dull orange-citrine. These differences, however, are slight and, while useful for subspecific recognition in the presence of a comparative series of museum specimens, are insufficient, by themselves, for reliable identification in the field. The only published field observations of *M. macconnelli* to date are from a single study of behaviour and nesting of *M. m. macconnelli* north of Manaus, Brazil by Willis *et al.* (1978).

TABLE 1

Measurements of McConnell's Flycatcher (*Mionectes m. macconnelli* and *M. m. roraimae*). *N* = no. of examples. Values are mean  $\pm$  standard deviation, and range. Sexes are combined; wing measured (flat), tail (longest feather). Means of wing measurements and of tail measurements between *macconnelli* and *roraimae* are significantly different (*t*-test, *p* < 0.001)

Taxon	<i>N</i>	Wing	Tail
<i>M. m. macconnelli</i>	14	64.0 $\pm$ 3.03, 58.3–68.4 mm	50.6 $\pm$ 2.90, 46.1–55.7 mm
<i>M. m. roraimae</i> *	66	61.6 $\pm$ 1.90, 57.2–65.3 mm	46.5 $\pm$ 1.85, 44.0–50.7 mm

\*includes measurements from *roraimae* (*n* = 52) and specimens originally described as '*mercedesfosteri*' (*n* = 14). No significant differences between the means of wing measurements (61.7 vs. 61.4 mm) and of tail measurements (46.5 vs. 46.7 mm) of *roraimae* and '*mercedesfosteri*' respectively (*t*-test, *p* > 0.05).

On 7 March 2001, at 1,450 m elevation in the Sierra de Lema (05°53'N, 61°26'W), Bolívar, south-eastern Venezuela, we first noted that vocalisations of highland *M. m. roraimae* differed from those of lowland *M. m. macconnelli*. Surprised by the dramatic differences in vocalisations, we began a series of systematic playback experiments and behavioural observations on *roraimae*, as well as its lowland counterpart *M. m. macconnelli*. As a result of our observations of playback responses, lek and song behaviour, elevational distribution and minor morphological differences, we believe these two taxa should be treated as biological species.

## Methods

Morphological measurements (Table 1) were compiled from specimens at the Colección Ornitológica Phelps (COP), Caracas (*roraimae*, *n* = 52; *macconnelli*, *n* = 3; *mercedesfosteri*, *n* = 13); Museo de Historia Natural, LaSalle (MHNLS), Caracas (*macconnelli*, *n* = 3); Univ. of Kansas Biodiversity Institute (KUBDI), Lawrence (*macconnelli*, *n* = 6); and the Field Museum of Natural History (FMNH), Chicago (*macconnelli*, *n* = 5; *mercedesfosteri*, *n* = 1). Measurements were made of flattened wing and longest tail feather to the nearest 0.1 mm with dial calipers. *T*-tests were used for statistical comparisons between the means of wing and tail measurements. Measurements of males and females were combined for statistical analysis. Three *M. m. macconnelli* specimens yielded insufficient data for analysis.

Our interpretation of the songs of *Mionectes* is based on the assumption that their vocalisations are inherited, as is the case for other suboscines (Kroodsma 1989, Kroodsma & Konishi 1991), and therefore vocal characters are useful for systematic study (Lanyon 1988). For our analysis of vocalisations we used recordings that we made at two highland locations in Venezuela and at one lowland site. For additional comparison we also used, in our trial experiments, recordings of lowland *M. m. macconnelli* made by A. Whittaker north of Manaus, Brazil. All vocalisations of both nominate *macconnelli* and *roraimae* are of birds either at leks or song perches, and are hereafter referred to as 'display calls'.

Initial observations and playback experiments on *roraimae* were conducted by both of us at the 1,450 m location noted above on 7 March 2001 and 18 February 2004, and on 14 March 2005 at a second highland site, at 910 m, in the Sierra de Lema (05°59'N, 61°23'W). Playback experiments with nominate *macconnelli* were made by both of us on 23–24 February 2004 at a lowland site (280 m) in the Santa Fe plot (08°05'N, 61°40'W) of the Imataca Forest Reserve, in Delta Amacuro, Venezuela. DA conducted additional playback experiments with highland *roraimae* in September 2001, August 2002, March 2003, December 2004, and June and December 2005, and with lowland *macconnelli* in June 2005. In August 2005 DA

found two *roraimae* singing at a third forested site (05°02'N, 61°03'W) along a road (1,100 m elevation) between San Francisco de Yuruaní and the village of Paraitepuy del Roraima, and conducted a single playback experiment with these individuals.

Location coordinates were obtained using a hand-held Garmin GPS. Mapped distributions of *M. m. macconnelli* and *M. m. roraimae* are based on (1) museum specimens and their localities in Hellmayr (1927), Phelps & Phelps (1950, 1963), Traylor (1979) and Hilty (2003); (2); documented sound-recordings; (3) records compiled by W. L. Brown for Ridgely & Tudor (1994); and (4) personal data from M. B. Robbins. All heights and distances are estimates.

Recordings by SLH were made with a Sony TCM-5000 cassette recorder and are deposited at the Cornell University's Macaulay Library of Natural Sounds (MLNS 172518 and 172549 *M. m. roraimae*; and 172565 and 172572 *M. m. macconnelli*). Recordings by DA were made using a Marantz digital PMD670/U1B recorder. Recordings by M. B. Robbins of *M. m. macconnelli* were made with a Sony Pro-II recorder (MLNS 108004, 108826). Those by A. Whittaker, with a Sony TCM-5000, are at the British Library of Wildlife Sounds (BLOWS, London). Sennheiser ME-67 microphones were used in all cases. Commercially available recordings of *M. m. macconnelli* can be found on a CD (Schulenberg *et al.* 2000) and a CD-ROM (Mayer 2000). Recordings by SLH of *M. m. macconnelli* and *M. m. roraimae* can be accessed via the MLNS website (as can M. B. Robbins' recordings from Guyana). Recordings of *M. m. macconnelli* also can be accessed on the Xeno-canto website ([www.xeno-canto.org/](http://www.xeno-canto.org/)). All of these recordings differ markedly from our recordings of highland *roraimae* and we encourage readers to listen to some of these to better appreciate the differences in the display calls of these two forms. The differences also can be seen in our sonograms (Fig. 2).

Playback experiments were conducted to observe reactions of both highland and lowland forms to the other's vocalisations. To determine reactions we presented an individual with a pre-recorded tape of the other taxon's vocalisation first. Each pre-recorded tape ran to a max. of c.2 minutes, presenting an individual with a minimum of six vocalisations of highland *roraimae*, and a dozen or more vocalisations of lowland *macconnelli*. Each playback trial with the other taxon's vocalisation was repeated at least twice with a buffer period of several minutes between each playback and an additional buffer of several minutes before the taxon's own vocal type was presented. We noted playback response (or lack of) and recorded response as simply strong, moderate or none. A strong response involved immediate approach and vocalisation (usually within 10–30 seconds); a moderate response was characterised by some vocalisation and limited approach usually after c.30–90 seconds of playback. When no approach or song was elicited by playback we noted the response as none. For playback we used our own recordings made at the sites mentioned above. Initially, a recording of lowland *M. m. macconnelli* made by A. Whittaker north of Manaus, Brazil was also used.

## Results

Wing and tail measurements of *macconnelli* were significantly different from those of *roraimae* (Table 1), with lowland *macconnelli* having slightly longer wing and tail lengths. Conversely, wing and tail measurements of the more recently described highland form *mercedesfosteri* were nearly identical to those of *roraimae*, thus supporting Fitzpatrick's (2004) conclusion that this form is unworthy of recognition. We therefore regard *mercedesfosteri* specimens as part of *roraimae* in our analysis but, to avoid confusion, identify them by name enclosed in quotes hereafter. When we played back an unknown vocalisation on 7 March 2001, in the Sierra de Lema, the singer responded immediately, perching close by and behaving nervously as it moved among branches 2.5–6.0 m above ground in

TABLE 2

Summary of playback responses by month. Responses defined as strong, moderate and none for *roraimae* and *macconnelli* to their own and to each other's display vocalisations. Strong implies an immediate response, moderate a slow or delayed response; none indicates no reaction (see text). Date (year) of playback trials are shown at bottom (superscript); each trial consisted of at least two 90-second playback attempts using each song type.

Months <sup>1,2</sup>	Dec.	Feb.	Mar.	Jun.	Aug.	Sep.
<i>roraimae</i> song to <i>roraimae</i>	strong	strong	strong	strong	moderate	none
<i>macconnelli</i> song to <i>roraimae</i>	none	none	none	none	none	none
<i>roraimae</i> song to <i>macconnelli</i>		none		none		
<i>macconnelli</i> song to <i>macconnelli</i>		strong		none		

<sup>1</sup>*roraimae* trials conducted March 2001, February 2004 and March 2005, and *macconnelli* trials February 2004 by SLH & DA.

<sup>2</sup>*roraimae* trials conducted September 2001, August 2002, March 2003, December 2004, and June and December 2005, and *macconnelli* trials June 2005 by DA.

wet premontane forest within an area of predominantly white sandy soil. Visually, we identified the bird as a McConnell's Flycatcher, but realised this vocalisation was unlike anything we knew from this species in the lowlands. While the bird sang we could hear another individual vocalising c.60 m distant. Subsequently, we have found *M. m. roraimae* at other highland sites in the Sierra de Lema region and southward in eastern Venezuela.

Following our initial sighting we conducted experimental playbacks, presenting highland *roraimae* with songs from lowland *macconnelli* and vice versa, and we have not observed a single instance in which the singer of one form appeared to recognise or respond to vocalisations of the other (Table 2). On the other hand, playback of *roraimae*'s own voice elicited a strong response in December, February and March, a moderate response in June and August, and none in September (Table 2). Responses of lowland *macconnelli* to recordings of their own voices, and to those of a *macconnelli* recorded near Manaus by A. Whittaker were strong during February visits to a lek, with birds vocalising and approaching immediately to within 1–2 m of the observer. In June 2005, DA revisited this lowland site of *macconnelli* and was unable to locate any birds or elicit any response to playback. One female of highland *roraimae* from Cerro de la Neblina, Amazonas, was reported to have large gonads in February; a second female had moderate-sized gonads in March. The results of our playback responses and the evidence of gonad size are preliminary, but suggest some breeding takes place early in the year.

## Distribution

The distributions of *macconnelli* and *roraimae* (including *mercedesfosteri*) are allopatric based on available data, but additional survey work may determine a few sites where they come together. In Venezuela the closest-known sites where *macconnelli* and *roraimae* approach are two *macconnelli* specimens (MHNLS 3725–3726) from km 104 (c.500 m) on the El Dorado–Santa Elena highway in eastern Bolívar, and our voice recordings and observations of *roraimae* at km 111.5 (910 m) on the same road. These records are separated by an elevational span of c.400 m but a straight-line distance that is probably no more than 5 km.

Lowland *macconnelli* is known from two areas in Venezuela, the Serranía de Imataca in north-eastern Bolívar, and sight records and voice recordings in the foothills of the Sierra de Lema close to the Guyana border (DA pers. obs.). All *macconnelli* records are from the lowlands below 500 m. We found one specimen labelled as *macconnelli* (MHNLS 10295)

from 950 m in the upper río Yuruani, Venezuela, but its measurements fall within the range of those of *roraimae*, not *macconnelli*. In Guyana, M. B. Robbins (pers. obs.) found *macconnelli* in lowland forest at 475 m at Waruma camp (KUBDI 86472) close to the base of Cerro Roraima, and obtained voice recordings of *macconnelli* up to 500 m. Robbins also found *roraimae* at 700–1,075 m on Ayanganna tepui in Guyana and these elevations generally agree with those in Venezuela (below).

Mean elevation for a sample of *roraimae* specimens ( $n = 96$ ) in Venezuela is about 1,580 m. All but two Venezuelan specimens of *roraimae* have been taken between 640 and 1,900 m, and all '*mercedesfosteri*' have been taken at 1,200–1,500 m on Cerro de la Neblina (Willard *et al.* 1991) and 1,300–1,980 m on Cerro Duida (Dickerman & Phelps 1978). The two exceptions of *roraimae* are from Cerro Chimantá in Bolívar (COP 35980) and Cerro Yaví in Amazonas (COP 8129), both taken at 500 m, but these are from areas where *macconnelli* is absent. *M. m. roraimae* has been found recently in Brazil, at Serra do Tapirapeco between 335 and 1,200 m, and at Serra do Xamata (00°29'N, 65°16'W) between c.600 and 1,000 m (M. Cohn-Haft & L. N. Naka pers. comm.). The Serra do Tapirapeco record is lower than the taxon has been reported elsewhere.

## Voice

Sonograms of display calls of the two taxa are shown in Fig. 2. We have not heard or recorded any vocalisations of either form away from their display areas, a behaviour that is consistent with other members of the genus, which are generally quiet when away from display and calling perches. *Macconnelli* gives several display calls or combinations of calls that are varied in tempo and pattern, but not far-carrying. The commonest display calls we recorded included a raspy, harsh *ruk'a-ruk'a-ruk'*... comprising a variable number of notes given in irregular sequences and repeated at intervals ranging from a few seconds (Fig. 2A) to a minute or more. This harsh note is also given singly or doubled, e.g. last image in Fig. 2C. *Macconnelli* also frequently utters a single buzzy *qerrr* that descends (Fig. 2B, arrows). This call also is often followed by a nasal series of zipping notes lasting c.1 second, the sound rising slightly in pitch and then leveling (middle two images in Fig. 2C).

All of these vocalisations were given during dawn calling bouts, often almost frantically for a few minutes with all birds participating in the activity. Display calls were accompanied by much wing-flicking, with birds frequently executing short looping flights of c.1–2 m, during which they called and then returned to the same or a nearby perch. Bouts of intense display calling were interrupted by periods of quiet lasting from a few seconds to a few minutes when relatively few display calls were given. In dim, early-dawn light near the forest floor, where these displays and vocalisations took place, the context of vocalisations could not be determined but bouts of such intense calling and display suggested that a female might have been present during these periods. Willis *et al.* (1978) described the display song as a '... series of rough, thrush-like "wiib" notes ... varied now and then with an odd and rapid nuthatch-like "rin-tin-tin-tin-tin-tin-tin-tin-tin-tin"'. These transcriptions generally correspond to the raspy *ruka'a-ruk'a* ... and *ruk, ruk, ruk* ... series of notes that we describe above. These and other calls, as noted by Willis *et al.* (1978), are unlike the calls of *M. oleagineus* and nearer those of *M. rufiventris* of south-eastern Brazil. In fact, the display songs of *roraimae* (next paragraph) and *macconnelli* differ from each other as much as either one does from *M. oleagineus*.

Display calls of *roraimae* consist primarily of a complex, jangling rattle of c.10–15 notes over 0.6–1.5 seconds that sounds as if it is produced by two birds (Figs. 2D–E; MLNS 172518, 172549). The display call is louder and more far-carrying than any display vocalisation given by *M. macconnelli*. When excited, *roraimae* utters rattle notes singly in a slow, irregular series

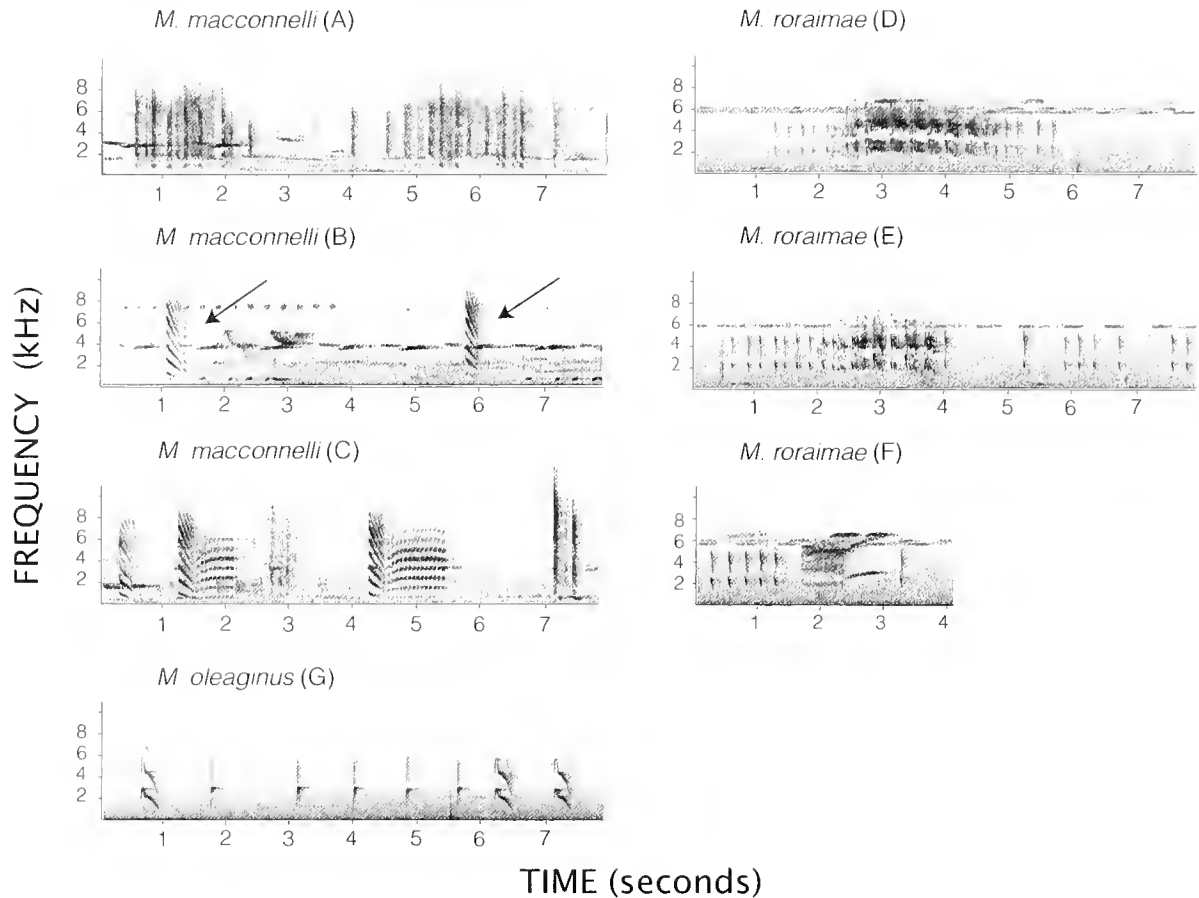


Figure 2. Sonograms of vocalisations of *M. m. macconnelli* (A–C) and *M. m. roraimae* (D–F) forms of McConnell's Flycatcher and allied Ochre-bellied Flycatcher *M. oleaginus* (G) for comparison. Arrows in example B indicate the characteristic buzzy vocalisation of *M. m. macconnelli* during display.

that sometimes lead to another display call, e.g. as in the seven well-spaced notes at end of Fig. 2E. The unmusical display call described above is occasionally followed by a few single notes, then by a weak, upslurred series of thin zipping notes (Fig. 2F), like fingers running along a tiny comb. The notes in this 'comb' phrase recall the buzzy *macconnelli* vocalisation in Fig. 2C, but those of *roraimae* are uttered at a faster rate, are much thinner, weaker and higher pitched, and heard far less often. Display calls of *roraimae* are given at a rate of c.1–4 / minute during optimum early-morning hours but increase to a max. of c.8 / minute after playback. *M. m. roraimae* may have other calls, but we have not documented them and we believe that its repertoire is less varied than that of *macconnelli* and its call rate much lower.

## Habitat and behaviour

Collection locations, our observations, and those of M. B. Robbins indicate that *macconnelli* and *roraimae* are almost or entirely separated by elevation in eastern Venezuela and Guyana. Both taxa occur inside humid forest with relatively open understorey. However, the forested slopes of the tepuis, where *roraimae* is found, are cooler and wetter and rainfall is probably less seasonal than in the lowlands, where *macconnelli* occurs. All of our observations of *roraimae* are in humid forest on sandy soil near the Gran Sabana or in rocky areas with boulders and large rock outcrops. The lek of *macconnelli* that we located in February was inside humid lowland rainforest with a fairly open understorey and several buttressed trees and large vines. The terrain at the display site was flat to gently sloping

and drained away toward a shallow ravine with dense undergrowth. When calling and displaying, *macconnelli* perched at heights c.0.3–2.5 m above ground (rarely to 3 m up) and, as noted by Willis *et al.* (1978), this species is fond of perching and displaying on tree buttresses or vines near buttresses, and usually vocalises when quite close to the ground. *M. m. roraimae*, by contrast, was always observed calling and displaying alone on small branches at heights of c.2.5–7.0 m above ground (rarely 1.5–20 m up), thus markedly higher than *macconnelli* and utilising a wider range of perch heights.

At dawn a minimum of six birds occupied the *macconnelli* lek we observed. The entire group displayed within a relatively compact area of c.15–30 m. At least three birds spent most of their time within a few metres of each other. It is unknown if the birds in this group, presumably males, occupied small fixed or floating territories during these early-morning calling sessions, but individuals seemed to return to certain perches frequently. Activity levels were high on both mornings of observation and periodically reached almost frantic levels during the first two hours after dawn. Thereafter activity declined, calling became less frequent and, by mid morning, most birds had dispersed. During midday we heard no vocalisations and the display area appeared deserted. We were not able to make afternoon observations, but we did not observe males occupying well-spaced, linear calling territories anywhere in the area, as reported at Reserva Ducke, north of Manaus (Willis *et al.* 1978). However, this could occur during midday or at other places or times of the year.

Typically we have found *roraimae* singly, in loosely associated twos, or less often in well-separated threes or fours. M. B. Robbins (pers. comm.) also reports loose groups of up to four on Ayanganna tepui in Guyana. *M. m. roraimae* has not been found in compact display groups similar to those we observed in lowland *macconnelli*, nor in numbers greater than four. In our experience, calling birds were always well separated from conspecifics (estimated 15–60+ m apart) and on most occasions probably out of sight of each other when vocalising but within hearing distance. We heard *roraimae* giving display calls mainly during early-morning hours but have not observed the level of intense, almost frantic activity in *roraimae* that sometimes characterises *macconnelli*. During late morning the calling sites of *roraimae* were often quiet. Brief playback always elicited a strong response during December, February and March, even if we did not initially hear the birds vocalising. Usually a bird would appear rather high overhead and then descend to call. Response to playback declined in June and August, although two individuals were noted calling spontaneously in August at one site. In September, DA was unable to elicit a response during playback trials.

## Discussion

*M. m. macconnelli* and *roraimae* recall closely related species-pairs of birds that behave as elevational replacements in the Andes (Terborgh 1971, 1985, Terborgh & Weske 1975) as well as the Spot-winged Antbird *Pernoestola leucostigma* / Roraiman Antbird *P. saturata* complex from the tepui mountains (Braun *et al.* 2005). Our evidence of vocal differences between *macconnelli* and *roraimae*, as well as differences in display behaviour, distribution and certain differences in morphology indicate that these two forms should be regarded as distinct biological species.

*M. m. roraimae* is not threatened by habitat loss. It is found across most of the tepui mountain region and the Caura watershed in southern Venezuela, and immediately adjacent Guyana and Brazil. Few roads penetrate this area, rapids prevent or hinder river access, and consequently human population is extremely low. Except for a small number of isolated airstrips, mostly associated with mining, the habitat of *roraimae* remains largely inaccessible to human activities.

A portion of *macconnelli*'s range in Venezuela, including where we observed it, lies within a large forestry reserve east of El Palmar, Delta Amacuro. It remains largely unreported in lowland forest elsewhere in north-eastern Bolívar or southern Delta Amacuro, areas that are becoming increasingly deforested. Overall the species is widespread, but certainly uncommon in lowland rainforest across the Guianas and eastern Brazil where large areas of intact forest remain.

The English name McConnell's Flycatcher has been in widespread use for all forms of this species and is best retained for the nominate form. No English name exists for highland *roraimae*. Group names, i.e. Lowland and Highland McConnell's-Flycatcher respectively, are helpful geographically and retain a historical connection, but imply a shared ancestry that is unproved. M. Cohn-Haft (pers. comm.) noted that because *M. roraimae* and *M. oleagineus* share an orange mouth lining (unlike *M. macconnelli*, which is apparently black throughout its range), *roraimae* and *macconnelli* might not be each other's closest ancestors. With this in mind, we suggest that highland *roraimae* be called Sierra de Lema Flycatcher after the mountain range where we first discovered its unusual song.

In south-western Amazonia, two taxa, *M. m. peruanus* and *M. m. amazonus* occur in the Amazonian lowlands and southern Andean foothills, and also appear to be separated by elevation. *M. m. peruanus* occurs up to 1,200 m on the east Andean slope of central Junín in Peru (Peters 1979, Schulenberg *et al.* 2007) but is poorly known and its voice is apparently unrecorded. Its plumage is brighter olive above than *macconnelli* and tinged ochraceous, with cinnamon-tipped wing-coverts and paler, more buffy-orange underparts, making it the most readily identified taxon of the group.

The distribution of *amazonus*, if accorded subspecies status, includes north-eastern Bolivia (up to 2,400 m) in dptos. Pando, Beni, La Paz, Cochabamba and Santa Cruz, and in south-eastern Peru in Ucayali and Madre de Dios, and possibly along the río Javará. A second cluster of *amazonus* records (Traylor 1979, Fitzpatrick 2004) occurs eastward in central Amazonas, central Pará, and northern Mato Grosso, Brazil. The plumages of birds from these two populations of *amazonus* are so similar to that of *macconnelli* that Fitzpatrick (2004) subsumed all of *amazonus* into *macconnelli* despite the apparent gaps between their ranges. However, Miller *et al.* (2008), found that lowland *M. macconnelli* is polyphyletic with southern Amazonian birds (*amazonus*) sister to all other lowland *Mionectes* including those of the Guiana Shield lowlands. To date, we believe that no DNA sequence data exists for either of the upper-elevation taxa (*peruanus* or *roraimae*). Further study may reveal important differences in *peruanus* as well.

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# The first described nests of Black-bellied Cuckoo *Piaya melanogaster*, from French Guiana

by Johan Ingels & Mathias Fernandez

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**SUMMARY.**—Although widespread throughout Amazonia, little is known of the breeding biology of Black-bellied Cuckoo *Piaya melanogaster* and its nest has not been described. We found two nests in French Guiana, both with two nestlings. The open, cup-shaped nests were constructed with twigs, pieces of vine and dead leaves within dense tangles of vines. The nestlings were mainly fed hairy caterpillars and, to a lesser extent, other arthropods. Our observations suggest that the species' breeding biology is similar to that of the closely related and better-known Squirrel Cuckoo *P. cayana*.

The non-parasitic cuckoos of the genus *Piaya*, Squirrel Cuckoo *P. cayana* and Black-bellied Cuckoo *P. melanogaster*, are widespread over most of the New World tropics. They possess discreet behaviour, moving furtively through the forest canopy or other tall vegetation, and are easily overlooked. They feed on a variety of arthropods, most frequently on hairy, noxious caterpillars. Of the two *Piaya*, only the breeding biology of the Squirrel Cuckoo is more or less known. Its open cup-shaped nest of twigs and sticks is constructed in a tangle of lianas or vines, in dense shrubbery or in overgrown trees. Clutch size is two, rarely three, white eggs (Payne 1997, 2005, Erritzøe *et al.* 2012).

Black-bellied Cuckoo occurs in eastern Venezuela, south-eastern Colombia, the Guianas, eastern Ecuador, eastern Peru, northern Bolivia, and from Pará, Amapá and across Brazilian Amazonia to northern Mato Grosso. It mainly occupies the canopy and subcanopy of *terra firme* forest and low forest on sandy soil, although it is occasionally observed at forest borders and in shrubby vegetation away from forest, or in savanna woodland. It is generally thought to be uncommon, but its secretive behaviour makes it difficult to observe, and the species is the least known of the *Piaya* cuckoos, while its nest remains undescribed (Payne 1997, 2005, Erritzøe *et al.* 2012). In French Guiana, the species is confined to the country's interior forests, where it is rather common, and it is absent from the littoral (Tostain *et al.* 1992). Only one breeding record for Black-bellied Cuckoo is mentioned in the literature. In late July 1989, adults attending a nest with nestlings were observed along the piste de Saint-Elie (c.05°17'N, 53°03'W) in French Guiana, but no details are known (Tostain *et al.* 1992). We report here on two nests of Black-bellied Cuckoo also found in French Guiana.

## Methods

The site of the two nests was an islet forming part of the Saut Mapaou, a rapid on the Approuague River (04°12'N, 52°18'W). The distance between the island and the riverbank on one side was c.10 m. On this bank, MF owns a clearing of c.0.5 ha with a shelter, which he visits at irregular intervals. The islet has a surface area of approximately 10 × 5 m and is completely covered by vegetation, with a tall tree, c.12 m high. The first nest was constructed in the tree and was observed for a total of approximately 12 hours from a distance of c.3 m by MF between c.07.00 h and 12.00 h during the mornings of 16 and 17 August, and between c.14.00 h and 16.00 h during the afternoon of 16 August 2013. The

second nest was constructed in the same tree, but was only visited briefly on 11 November 2013 to check the contents.

## Results

On 15 August 2013, the attention of MF was drawn by Black-bellied Cuckoos flying to and fro between the riverbank and the islet in the rapid. On searching the islet, MF discovered the birds' open, cup-shaped nest c.8 m above ground in a dense tangle of vines around a fork at the tip of a horizontal branch (Fig. 1). It was constructed of twigs, pieces of dry vine and dead leaves, and resembled suspended litter, which made it difficult to locate the nest from below. The external diameter and the total height of the nest were c.25 cm and 10 cm, respectively. It contained two nestlings, approximately  $8 \pm 2$  days old (Fig. 2).

The adult cuckoos were not shy. They continued their provisioning activities in a normal way when MF was sitting in the tree. By day, they brought food to the nest approximately every 45 minutes. However, from sunrise (at c.06.20 h) to c.09.00 h and from c.17.00 h to sunset around 18.30 h, provisioning was much more frequent, with intervals between feedings of just 10–15 minutes.

All foraging occurred in the canopy of trees on the mainland. An adult with prey always arrived on the islet and then at the nest in the same way. On arriving at the riverbank, it first perched for several minutes in the vegetation, observing the surroundings before flying to the islet (Fernandez & Ingels 2014). There, the adult hopped up through the vines to the nest. It always arrived from below, never from above, and always via the same route. On departing the nest, the adult flew off directly or hopped to a nearby vine and then flew to the riverbank.

Just prior to arriving at the nest, an adult with prey would utter a few soft calls to which the nestlings would respond with begging calls. These loud begging calls could be heard on the riverbank i.e. from a distance of c.12 m. Transfer of prey and occasional removal of a faecal sac occupied <1 minute, following which the adult immediately departed. In the first hour or so after dawn, when feeding rates were most intense, faecal sacs were removed during each provisioning, three during the first morning and four the second morning. During the day when provisioning was infrequent, faecal sacs were removed less often.

The inside of the gape of the nestlings was bright red and the palate showed small white knobs (Fig. 3). The nestlings were mainly fed hairy caterpillars and, to a lesser extent, with grasshoppers, crickets and other arthropods (Fernandez & Ingels 2014). Caterpillars brought to the nest included *Automeris illustris* (Fig. 4), *A. hamata* and *A. liberia*, also a *Dirphia* sp. probably *tarquinia* (Hemileucinae, Saturniidae) and *Amphonyx duponchel* (Sphinginae, Sphingidae). Other prey included grasshoppers, crickets (Gryllidae), bush crickets (katydids, probably Pseudophyllinae, Tettigoniidae) and cicadas (Cicadidae), as well as wandering spiders, probably a *Phoneutria* sp. (Ctenidae). All caterpillars of the family Saturniidae have stinging hairs, and spiders of the family Ctenidae are poisonous (F. Bénélux pers. comm.). However, we assume that the adults squeezed the possibly toxic leaf remains from the guts of caterpillars before they were fed to the nestlings (Fig. 5).

On 18 August, in the late afternoon, the nest was found to have been destroyed and the nestlings had disappeared. It was most probably predated. The loud begging calls of the nestlings and / or MF's presence on the islet could have attracted the attention of predators. Possible predators seen in the clearing and on the islet included *Micrastur* forest falcons and Tayras *Eira barbara*.

On 11 November 2013, MF observed the cuckoos again flying to and fro between the riverbank and the islet. On visiting the islet, MF discovered that they had a new nest with nestlings. It was similar to the first and constructed in a very dense tangle of vines in the



Figure 1. Black-bellied Cuckoo *Piaya melanogaster* at nest within dense tangle of vines, French Guiana, August 2013 (Mathias Fernandez)

Figure 2. Nestlings of Black-bellied Cuckoo *Piaya melanogaster*, approximately  $8 \pm 2$  days old, French Guiana, August 2013 (Mathias Fernandez)



Figure 3. Nestlings of Black-bellied Cuckoo *Piaya melanogaster* uttering begging calls as an adult arrives with prey, the white knobs on reddish palate clearly visible; French Guiana, August 2013 (Mathias Fernandez)

Figure 4. Adult Black-bellied Cuckoo *Piaya melanogaster* with noxious *Automeris illustris* caterpillar, French Guiana, August 2013 (Mathias Fernandez)

Figure 5. Adult Black-bellied Cuckoo *Piaya melanogaster* with an *Automeris* caterpillar that has a drop of gut contents hanging from its rear, French Guiana, August 2013 (Mathias Fernandez)

same tree, but 4 m lower, at a height of c.4 m. The tangle of vines was so dense that it was impossible to see or photograph the young in the nest. However, when the adults arrived with food, MF heard begging calls of two different young and, from the intensity and a

comparison of these calls with the begging calls of the young at the first nest, he estimated that they were c.1 week old. Unfortunately, the survival of this nest could not be followed.

## Discussion

The nest sites of Black-bellied Cuckoos described here are similar to those chosen by Squirrel Cuckoos, i.e. dense shrubbery or a tangle of lianas or vines in trees (Payne 2005, Erritzoe *et al.* 2012). Both nests of Black-bellied Cuckoo were open cups, similar to the shallow platform or open-cup nests of Squirrel Cuckoo (Haverschmidt & Mees 1994, Payne 2005).

The first Black-bellied Cuckoo nest held two nestlings, which corresponds to the usual clutch size of Squirrel Cuckoos (Penard & Penard 1910, Payne 2005, Erritzoe *et al.* 2012). When found on 15 August, the nestlings were estimated to be  $8 \pm 2$  days old. With an estimated incubation period of 18–19 days as for the similar-sized Squirrel Cuckoo (Erritzoe *et al.* 2012), eggs would have been laid around 20 July. The nestlings in the second nest were probably one week old on 11 November, which suggests that eggs were laid on c.15 October, 8.5 weeks after the first nest disappeared and 12.5 weeks after the first clutch was laid. Black-bellied Cuckoos probably nest several times in a season, like Squirrel Cuckoos (Payne 1997), meaning that the second clutch should not necessarily be viewed as a replacement.

Our observation of approximately one feeding of the nestlings per 45 minutes during the day corresponds well with the single feeding per hour given for Squirrel Cuckoos (Skutch 1966). Many of the caterpillars and arthropods fed to the nestlings have stinging hairs and/or are noxious. The adults probably squeeze the possibly toxic leaf remains from the guts of most caterpillars, but it did not appear that stinging hairs are removed. We did not observe if the nestlings regurgitated these hairs in pellets, as adults do (Payne 1997).

The white knobs on the reddish palate of the nestlings are remarkable. Skutch (1966) stated that the gape of Squirrel Cuckoo nestlings is bright red, although he did not mention the presence of white knobs or markings. The gapes of nestlings of Guira Cuckoo *Guira guira*, *Crotophaga* species and some *Coccyzus* species also possess bright, whitish markings that contrast strongly with the red palate (Sick 1993, Payne 1997). Such markings may assist the adults to place food in the chick's open bill, especially in a dark nest within dense tangles of vegetation, as is often the case for *Piaya* cuckoos. However, the question then remains why these markings should only occur in nest-building cuckoos and not in those that parasitize host species with a domed or closed nest, e.g. Striped Cuckoo *Tapera naevia* and both *Dromococcyx* (Payne 1997).

In Guyana, Squirrel Cuckoos have been recorded breeding in April and July–September (Erritzoe *et al.* 2012), and in Surinam in July (Ribot 2013), while eggs in the Penard collection were collected in March–July and September (Haverschmidt & Mees 1994). In French Guiana, nests under construction were found in March and August, and a nest with young in July (Tostain *et al.* 1992). In Amapá and Pará (Brazil), nesting has been observed in January, March, May, July and August (Payne 2005, Erritzoe *et al.* 2012). In French Guiana, Black-bellied Cuckoo nests with nestlings have been found in July (Tostain *et al.* 1992), and August and November (this paper). Thus, over the Guiana Shield (French Guiana, Surinam, Guyana and adjacent regions of Brazil), *Piaya* cuckoos appear to breed from January to November, i.e. from the onset of the short dry season (February–April), through the long rainy season (May–mid August) until the end of the long dry season (mid August–November) (Penard & Penard 1910, Payne 2005, Erritzoe *et al.* 2012). As Squirrel Cuckoos nest several times over the course of a single season (Payne 1997) and there does



not appear to be any seasonality in breeding by either *Piaya*, they probably breed year-round in this region.

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# Rediscovery of the syntypes of California Quail *Tetrao californicus* Shaw, 1798, and comments on the current labelling of the holotype of California Condor *Vultur californianus* Shaw, 1797

by Robert P. Prŷs-Jones, Douglas G. D. Russell & Sheila Wright

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**SUMMARY.**—The two syntypes of California Quail *Tetrao californicus* Shaw, 1798, were deposited in the British Museum in the 1790s, but were last documented as present in the late 1860s and had subsequently been presumed no longer extant. In 2004, they were re-discovered in Nottingham Natural History Museum, to which they must have been inadvertently passed as ‘duplicates’ in the late 1800s, and have now been returned to the Natural History Museum, Tring, on extended renewable loan. During research regarding these Archibald Menzies specimens, new insight was gained into hitherto confusing reference details on the label of his type specimen of California Condor *Vultur californianus* Shaw, 1797

Archibald Menzies (1754–1842) was surgeon and naturalist on Captain Vancouver’s ship *Discovery* during its voyage between 1791 and 1795 to the north-west coast of North America (Galloway & Groves 1987, Groves 2001, McCarthy 2008). Although primarily a botanist, he became the first scientific collector of Californian birds during periods between November 1792 and November 1794, when *Discovery* visited various points on the coast of the future state (Grinnell 1932a, McCarthy 2008, Wilbur 2012). Among the birds he collected, two new species were described by George Shaw from specimens deposited in the British Museum<sup>1</sup> (BM): California Condor *Vultur californianus* Shaw, 1797, and California Quail *Tetrao californicus* Shaw, 1798 (Fig. 1) (authorship and dating follows Dickinson *et al.* 2006); following Dickinson & Remsen (2013), these two species’ current names are, respectively, *Gymnogyps californianus* (Shaw, 1797) and *Callipepla californica* (Shaw, 1798).

Menzies’ own voyage journals had a chequered history after his death (Groves 2001), but based on less than definitive statements in the sections relating to California in the journal up to 14 February 1794, whose whereabouts was then known (Eastwood 1924), Grinnell (1931, 1932b) concluded that the type locality of the California Quail was almost certainly Monterey and that the specimens were very probably taken on 5 December 1792. This conclusion is generally accepted, despite McCarthy’s (2008) suggestion that the date was probably 6 January 1793, which is based on an erroneous ascription of date to his quoted sections of Menzies’ journal. With less certainty, Grinnell (1932b) reached the same conclusion regarding the type data for the California Condor specimen, but based on the intervening rediscovery of the section of Menzies’ journal up to 18 March 1795, this was challenged by Wilbur (2012), who suggested that either November 1793 at Santa Barbara or November 1794 at Monterey would appear more probable.

<sup>1</sup> A brief clarification on changes to institutional nomenclature and location may be helpful at the outset. The British Museum (BM) in Bloomsbury, London, was founded in 1753, but its natural history departments became the British Museum (Natural History) (BMNH) following their move to South Kensington, London, in 1881, although full legal separation did not occur until 1963. The BMNH’s bird collections were subsequently moved to Tring at the start of the 1970s. In 1992 the BMNH changed its name to the Natural History Museum (NHM).



Grinnell (1932a) reported that in 1930 the single type specimen of California Condor was still present at BMNH, whereas both type specimens (male and female) of California Quail had disappeared. Based on Sharpe's (1906) comment that all specimens acquired by the BM up to the 1860s tended to be mounted for display, with the result that many became faded or broken and were consequentially often replaced by newer specimens, Grinnell (1932a: 251) inferred that they 'doubtless were thrown away'. However, although many early specimens certainly did suffer this fate, it is also true that, as the BM's representation of many bird species vastly increased during the late 1800s and early 1900s, there was a proactive policy of assisting provincial and colonial museums through donation to them of both older, often data-poor, specimens and newly acquired unwanted and unregistered material, both often annotated on their labels as 'duplicates' (Günther 1912, Knox & Walters 1992). Although each older specimen donated elsewhere should in theory have had its departure noted against its register entry, in practice this did not always happen, probably because staff were overwhelmed by the sheer volume of incoming and, to a lesser extent, outgoing material at this time.

The two Menzies specimens of California Quail came to BM in the late 1790s, well before the current specimen registration system was introduced in 1837 (Wheeler 1996, Thomas 2012). Their presence was, however, noted in a slightly earlier BM attempt at cataloguing bird specimens by species, i.e. the Vellum Catalogues, which were initiated in 1835 and then utilised on a very partial basis until 1843, when they were discontinued, probably because the first attempt at publishing catalogues of BM bird specimens was beginning (Thomas 2012). Within the Vellum Catalogue system, the two specimens were recorded as 72a and 72b in vol. 34 (which sex corresponds to which number is not clear), one of two volumes containing the order Gallinae according to the system of Temminck, which was followed for all non-British birds (Thomas 2012). Their continuing presence in the BM can be traced through unambiguous mentions in two early published catalogues by Gray (1844: 44, 1867: 79). However, when Ogilvie-Grant (1893) published the relevant volume (22) of the comprehensive *Catalogue of the birds in the British Museum (Cat. Birds BM)*, it contained no reference to them, providing strong evidence that they were by then either no longer in the BMNH's collection or had already been consigned to duplicates before he began preparing it. Unfortunately, their Vellum Catalogue entries have no annotation as to their fate.

On a visit to Nottingham Natural History Museum in early 2004, DGDR made notes on an array of bird skin specimens with BM labels, some with registration numbers and some unregistered. Having long been puzzled as to the fate of Menzies' California Quails, RPP-J immediately recognised that the data accompanying the two Nottingham specimens



Figure 1. Illustration accompanying the original description of the male syntype of *Tetrao californicus* Shaw, 1798 (Harry Taylor / © Natural History Museum, London)



Figure 2. The male (a) and female (b) syntypes of *Tetrao californicus* shown above their BM labels (front and back) (Harry Taylor / © Natural History Museum)

(V0855B and V0854B) showed them to be the missing male and female respectively (Fig. 2a,b). Each has 'Pres. by A. Menzies' on its BM label, with the male also having 72a and the female 72b in the space for 'Brit. Mus. Reg.', a style typical for Vellum catalogue numbers when the specimen had not also received a registration number; each further has 'Dupl.' written on its label, showing that they had been deemed surplus to requirements. A further inscription in

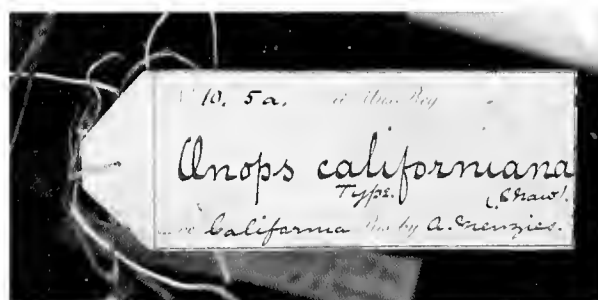


Figure 3. The BM label from the holotype of *Vultur californianus* (Harry Taylor / © Natural History Museum, London)

tiny writing on the reverse of each label enables the period when they left BMNH to be defined more precisely: the male has 'No. 24, Burton 17.xi.84', whereas the female has 'No. 12, West 1.iii.86'. These give the dates on which the BMNH sent each specimen to one of the 'stuffers', who from the 1870s through 1890s it contracted to de-mount older mounted specimens (Knox & Walters 1992). A set of 17 notebooks, numbered 1–19 (8–9 were blank), still exist that summarise batches of specimens sent out (Knox & Walters 1992), and de-mounting details for the male and female are corroborated in vols. 7 and 16 respectively. Neither specimen can therefore have been given away earlier than 1885/86, nor probably later than c.1892, prior to finalisation of the text for Ogilvie-Grant (1893).

A search of a couple of BM registers from the 1870s reveals notes regarding specimens therein that were passed to Nottingham Museum in both April 1882 and January 1895, but not during the period 1885–92. Seemingly there may have been at least one additional donation of 'duplicates' to Nottingham that was not properly recorded. As indicated earlier, this is not surprising. A direct parallel exists in three exchanges that the BMNH conducted with the collector Gregory Mathews in the early 1900s, two of which had the outgoing specimens correctly annotated as such in their registers and one which did not (RPP-J pers. obs.).

As to why the significance of the Menzies specimens as types for the name *Tetrao californicus* was not recognised, the general importance of type material present in the BM bird collection was only properly documented for the first time from the start of production of the 27 volumes comprising the *Cat. Birds BM* (1874–98). The Menzies California Quail specimens were clearly consigned to duplicates shortly before work got underway on the relevant volume for gamebirds, and therefore had presumably yet to be investigated in this regard.

The two California Quail specimens are in remarkably good condition for their age and, notwithstanding the comments of Grinnell (1931), the male (Fig. 2a) is in reasonable agreement with the illustration in the 1798 type description (Fig. 1). Following recognition of the find, agreement was reached between Nottingham Museum and the NHM in 2009 that the specimens would be returned on an extended renewable loan to the NHM, where they would be stored with NHM's large collection of avian type specimens and made available for study. Following a delay linked to extensive renovation work then taking place in the building housing the NHM bird collection, the transfer was effected in 2012.

During research into the status of the Menzies California Quails, a new insight was gained into the present labelling of the Menzies California Condor. As Grinnell (1932a,b) noted, the only label now attached to this is a BM one that is clearly of much later origin than the specimen itself, though it does also bear a small metal tag of a type often used, with a scratched-on identifying number, on early 1800s BM bird specimens; unfortunately nothing is now discernable on this tag. In the space for 'No.' on the label (NB—not the space for 'Brit. Mus. Reg.') is written '10. 5a' (Fig. 3). As the specimen is no. 2 in vol. 5 of the Vellum Catalogue, this number clearly does not refer to this, and Grinnell (1932a: 252; 1932b: 265) assumed it was 'probably a taxidermist's memorandum'. In fact, it relates to the specimen's entry in the first volume of *Cat. Birds BM* (Sharpe 1874), in which it is specimen *a* of the fifth species (*californiana*) of the tenth genus (*Oenops*) included therein.

The entire inscription on the Menzies California Condor label is in the same handwriting, and the label was clearly produced by Sharpe, or a clerk acting on his behalf, during preparation of this volume. This assertion is supported by the use of *Oenops californiana* on the label, the genus being one not only introduced by Sharpe (1874: 20 *et seq.*), but also synonymised by him in the *Addenda* (p. 455) of the same volume! The statement 'Type' is also written on the label, and Sharpe (1874: 29) indeed flagged the specimen as

such. The issue of a label number linking a specimen to its *Cat. Birds BM* genus/species/specimen entry is not something that we are familiar with, and its scope and implications merit wider investigation. What label, if any, that the Menzies California Condor may have been accompanied by at the time Sharpe attached the current one remains unclear—very possibly it was one from a display stand, as the specimen had certainly been mounted and displayed from at least as early as 1816 (Thomas 2012), but this is speculation.

In conclusion, our relatively cursory examination of ex-BM specimens held by Nottingham Museum turned up several exciting finds, including two even more historic specimens than those mentioned here, to be documented by Russell & Wright (in prep.). The scale of the BM's disbursement of old specimens during the 1800s and early 1900s, not all of which were properly documented, means that numerous other important discoveries may await systematic investigation in the bird collections of provincial museums and even schools.

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## The Spotted Green Pigeon *Caloenas maculata*: as dead as a Dodo, but what else do we know about it?

by Hein van Grouw

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**SUMMARY.**—Described in 1783 and since then re-examined by many notable ornithologists, the single specimen known as the ‘Spotted Green Pigeon’ *Caloenas maculata* in the collections of the World Museum, Liverpool, has always been a mystery. No-one has ever doubted that it is a pigeon, and many researchers were convinced it was a distinct species. Although its taxonomic status remained unclear, it was officially declared extinct by BirdLife International in early 2008. Recent DNA analysis has now revealed that Spotted Green Pigeon can indeed be considered a distinct species within the extended Dodo *Raphus cucullatus* clade of morphologically very diverse pigeon species. Most members of this clade exhibit terrestrial or semi-terrestrial habits. Further morphological research into this unique specimen, initiated by the World Museum, demonstrates that Spotted Green Pigeon, in contrast to its fellow clade members, may have possessed strongly arboreal habits.

The Spotted Green Pigeon *Caloenas maculata*, represented by a single specimen held in the scientific collections of the World Museum, Liverpool, has always baffled ornithologists. Although its provenance is unknown, the confusion has mainly centred on whether it is a valid species; that the specimen is a pigeon has never been questioned. Because of its green-glossed plumage and slightly elongated hackles, it is usually assumed to be allied to Nicobar Pigeon *C. nicobarica*, although they share few other morphological features.

The possibility it being an aberrant individual of a known species or even a hybrid was often suggested in the past. Although Nicobar Pigeon seemed to be a good candidate as one of the parent species, no other known pigeon species could have been responsible for the remarkable spotting. Recent DNA analysis has now revealed a new and unknown DNA lineage for Spotted Green Pigeon with close affinities to Nicobar Pigeon, suggesting that it was correctly placed in *Caloenas* (Heupink *et al.* 2014). Its lineage cannot be explained by hybridisation, as the specimen’s DNA is maternally inherited and does not mix with paternal DNA (T. H. Heupink *in litt.* 2013), so even if the specimen was a hybrid, this would mean that the mother (and her mother) was a new species close to *Caloenas*.

The DNA results have revealed that Spotted Green Pigeon is indeed a valid taxon, bringing the number of described species of *Caloenas* to three. The third species, described from sub-fossil remains, is Kanaka Pigeon *C. canacorum*, which is estimated to have been c.25% larger than Nicobar Pigeon, and occurred on New Caledonia and Tonga (Balouet & Olson 1989). The remains suggest that this species had no reduction in its ability to fly. As nothing is known about the feet, no tarsus or toe remains having been found, we know nothing concerning its behaviour (arboreal or terrestrial). Also, of course, external characters such as colour, markings and biometrics remain unknown.

Given, therefore, that of the genus *Caloenas* we have only the Nicobar Pigeon for direct comparison, the external morphology of Spotted Green Pigeon more closely resembles that of imperial pigeons *Ducula*. It may therefore have had a comparable behaviour and ecology

to these strongly arboreal species, which differ from those of the more terrestrial Nicobar Pigeon.

## History of the specimen(s)

The first description of the species was in 1783 by John Latham (1740–1837) in *A general synopsis of birds*. Latham named it the Spotted Green Pigeon: 'Length twelve inches. Bill black, tipped with pale yellow: general colour of the plumage dark green, and glossy: the head and neck are darker than the rest, and of one plain colour: the feathers of the neck long and narrow, like the hackles of a Cock; every feather of the wings and scapulars tipped with a spot of very pale cinereous white, with a point running upwards, somewhat triangular: quills and tail black; the feathers of the first tipped with cinereous white, those of the last with ferruginous white, and even at the end: belly, thighs, and vent, dusky black: the legs are brown, and the shins covered half way with downy feathers: claws black.'

At the end of the description Latham (1783) added: 'In the collection of Major Davies. I likewise met with a specimen in that of Sir Joseph Banks. Native place uncertain.' This strongly suggests that Latham must have seen two Spotted Green Pigeon specimens; one belonging to Davies, the other to Joseph Banks.

Little is known about the collection of Major Thomas Davies (c.1737–1812), an army officer and topographical painter. Topographical drawing/painting was the only contemporary means of making a rapid and accurate visual record of military value and, as such, required the utmost attention to detail and fidelity to nature (Hubbard 1983). This may explain Davies' interest in birds. Between 1757 and 1790, he accompanied several expeditions as an army artist, mainly to Canada and North America (Hubbard 1983), during which he cultivated an interest in birds and taught himself to collect and prepare specimens (Davies 1770). Although he never visited the South Pacific, he nevertheless had contacts in New South Wales: Governor Philip, Colonel Nepean and Governor King all sent him specimens for his collection (Davies 1798, 1802), so his Spotted Green Pigeon may have originated from that region of the world.

After Davies' death his collection was auctioned in London (6 and 8 June 1812) and the Spotted Green Pigeon was bought by Lord Edward Smith Stanley (1775–1851), the 13th Earl of Derby, who held a substantial menagerie and private collection at his family seat, Knowsley Hall, just outside Liverpool. In Lord Stanley's personal copy of *A general synopsis of birds* (held in the World Museum, Liverpool), against Latham's statement, 'In the collection of Major Davies' there is an annotation, in Stanley's handwriting, 'now in mine'! It seems obvious from Latham's 1783 account that his description was entirely based on Davies' specimen, this therefore being recognised as the holotype of the species. In his collection's manuscript catalogue (also at the World Museum), Lord Stanley registered the specimen as, '324, Spotted Green Pigeon, *Columba maculata*' with the country of origin being given as 'uncertain'. His collection, originally known as the Knowsley Museum, came to the city of Liverpool by bequest in 1851. After its transfer it was known as the Derby Museum, the core of which later became the Liverpool Museum, now the World Museum, National Museums Liverpool.

The collection of Joseph Banks (1743–1820) was famous during his lifetime and included many specimens collected during Captain James Cook's three voyages around the world (1768–80). In 1792 Banks donated part of his collection to John Hunter (1728–93) and the rest to the British Museum. Following Hunter's death, his collection was purchased for the Company of Surgeons (which became the Royal College of Surgeons after 1800). These were later re-joined by some of the British Museum specimens, which had meanwhile been stored in a basement in a state of neglect and were purchased by the Royal College

of Surgeons in 1809. The specimens in Hunter's collection were numbered and, in 1806, catalogued under these numbers (Burton 1969).

The catalogue, Copy of Dr Shaw's catalogue of Natural History in the Hunterian Museum, is still present in the archives of the Royal College of Surgeons (ref. no. MS0471/2) and lists mainly spirit specimens. Only 87 'stuffed animals' are listed, both birds and mammals, but no *Columba maculata* is among them! The additional specimens acquired in 1809, however, were neither numbered nor catalogued, so their identification remains mysterious. Banks was, without doubt, the principal recipient of bird specimens collected on Cook's three voyages (Medway 2009) but, unfortunately, he appears to have placed little value in them, freely giving them away well before his more substantial donations to Hunter and the British Museum in 1792. Neither did he make a serious attempt to catalogue his material. The only extant catalogues appear to have been completed between c.1776 and 1782, and these only mention specimens acquired during the Cook voyages (Medway 1979, 2009). From the existing literature, there is no indication that a bird resembling a Spotted Green Pigeon was ever collected during one of the voyages (Whitehead 1969, Medway 1979, 2009). If Banks did indeed possess a Spotted Green Pigeon specimen, he may have received it from someone else, perhaps from the same source as Major Davies? In sum, Latham's statement is the only clue that Banks may ever have owned a specimen of Spotted Green Pigeon, or that a second specimen ever existed.

Latham made it clear that he did not know where the Spotted Green Pigeon specimens came from, and never speculated as to their provenance. Later authors, however, based on the relationship between Davies, Banks and Cook, made the assumption that the birds came from the South Pacific, although there is no evidence in the literature that a bird even faintly resembling a Spotted Green Pigeon was received by Banks after Cook's third voyage (Medway 1979, Stresemann 1949, 1950, 1953). However, Davies *did* have contacts in that region and, moreover, contacts that provided him with bird specimens.

Besides the two specimens he had seen earlier, Latham, in his *A general history of birds* (1823), also mentioned a drawing: 'We have only seen two specimens; one in the collection of Gen. [sic] Davies, the other in possession of Sir Joseph Banks. In a drawing of one at Sir Ashton Lever's, the end of the tail is deep ferruginous.'

The celebrated collection of Sir Ashton Lever (1729–1788) was housed in a museum named the Holophusicon and was opened to the public in February 1775. However, due to financial pressures, in March 1786 Lever was forced to sell his entire museum by public lottery. Only 8,000 tickets were sold. The winning ticket belonged to James Parkinson and on 1 September 1787 the museum was closed and Parkinson moved the collection to a new building, changing its name from the Holophusicon to the Leverian Museum (Kaeppeler 2011).

Among the many artists who used the Leverian collection to produce illustrations for scientific works, the most prolific was Sarah Stone, whose artistic career centred on the Holophusicon. She continued her association with the collection during Parkinson's ownership (Kaeppeler 2011). Whoever executed the drawing referred to by Latham, it was probably based on a specimen. Latham himself also made many bird drawings from Lever's collection, reproduced as engravings in *A general synopsis of birds*.

Whether the pigeon drawing in Lever's collection was made from a specimen in his own possession, or another, is unknown. However, in *A general history of birds*, 40 years after his original description, Latham depicted a Spotted Green Pigeon (Fig. 1). Exactly when and where this illustration was produced is unknown, but it is unlikely to have been based on Davies' specimen as will be shown below. More likely is that he copied it from the drawing in Lever's possession, as the bird in Latham's picture also has a 'deep ferruginous' tail-band.



Although Latham's bird barely resembles a pigeon in shape, most of the morphological details are correct: the yellow bill tip, the pointed neck feathers, the greenish and spotted upperparts and the long tail. The long and spotted primaries and the rather pale-coloured underparts do not, however, match Davies' specimen in Liverpool, but this may not have been an error after all, as will be presently explained.

## History of the species

Gmelin (1788) used Latham's (1783) description to give the species a scientific name *Columba maculata* (meaning 'spotted pigeon'). Latham obviously accepted that name as he used it in his *Index ornithologicus* (1790), providing a much shorter description (originally in Latin): '*C. maculata*: Dark-green pigeon, with the body above spotted with whitish, the abdomen dusky, and the tail black, with a ferruginous tip.'

Temminck (1813) mentioned *Columba maculata* but, in addition to copying Latham's (1790) description, he questioned its status as a species. Stephens (1819) also mentioned the Spotted Green Pigeon, copying both of Latham's descriptions. Erroneously he called it *Columba Picazuro*, but this must have been a slip of the pen as in the text he refers to *Columba maculata* in Latham (1790), Gmelin (1788) and Temminck (1813). Latham again mentioned the Spotted Green Pigeon in *A general history of birds* (1823), this time also providing an illustration (Fig. 1). The English description is almost identical to the 1783 text, except for the addition of a note that the skin around the eyes is almost naked.

Wagler (1827) did not see the specimen, but he did mention *Columba maculata* based on Latham's and Gmelin's works, adding that, according to those descriptions, it might well be a juvenile *Columba gallus* (a synonym of *Caloenas nicobarica*). In Wagler's time the genus *Caloenas* had not been described (*Caloenas* G. R. Gray, 1840). A year earlier, Stephens (1826) placed *maculata* in *Ptilinopus*, suggesting India as its country of origin.

Salvadori (1893) included *Columba maculata* in the appendix among 'the doubtful species of Pigeons, which have not yet been identified', and repeated Latham's (1783) description. However, according to Forbes (1898), Spotted Green Pigeon was without doubt a *Caloenas* and a species: 'from the fact that there were two specimens in existence ... we are inclined to the belief that the *Columba maculata* of Gmelin, should be recognised as a good species *Caloenas maculata*.'

Rothschild & Hartert (1901) briefly mentioned the species in a footnote related to Nicobar Pigeon, dismissing Wagler's species identification: 'The most peculiar *Caloenas maculata*—correctly identified as a *Caloenas* by Wagler—is certainly not the young of *C. nicobarica*, as the young are almost quite like the adults, and not spotted. It is extraordinary that the home of this bird is not yet discovered, and we suggest the possibility—although there were two specimens—that it is an abnormality.'

Also in a footnote, Peters (1937) stated that 'the Spotted Green Pigeon of Latham has never been satisfactorily identified with any known species', and that Rothschild & Hartert believed it to belong to the genus *Caloenas*.

In 1953 Reginald Wagstaffe, Keeper of Vertebrate Zoology at the Liverpool Museum, asked Captain C. H. B. Grant for his opinion of the presumed type specimen of *Caloenas maculata*. Grant, an Honorary Associate of the British Museum (Natural History) replied, after seeing the specimen: 'I would not hesitate to say that it ... is adult, and has nothing to do with *C. nicobarica* ... I do not think it is anything but a good and distinct species. It may have come from some remote island and maybe is now extinct' (letter in Liverpool Museum archive).





Figure 1. Drawing (engraving) by Latham of Spotted Green Pigeon *Caloenas maculata* in *A general history of birds* (1823), presumably based on a picture in Lever's possession; Lever's picture may have been based on a third specimen.



Figure 2. Depiction of Spotted Green Pigeon *Caloenas maculata* in Forbes (1898), made by Joseph Smit and based on how Forbes assumed the species looked like.



Figure 3. Depiction of Spotted Green Pigeon *Caloenas maculata* in Fuller (2002) by Brian Small and based on how Fuller assumed the species looked like (courtesy of Lynx Edicions, Barcelona)



Figure 4. Depiction of Spotted Green Pigeon *Caloenas maculata* in Gibbs *et al.* (2001), made by John Cox and based on how Gibbs assumed the species looked like; perching on a branch is probably more accurate than walking on the ground (courtesy of Pica Press / Bloomsbury, London)

Whether it was because of Grant's opinion or not, Wagstaffe (1978) considered it a valid species in the type catalogue of the Liverpool museum as he stated '...there is no doubt that it represents a perfectly recognisable form, presumably now extinct.'

Nevertheless, Spotted Green Pigeon is not mentioned in the first edition of *Extinct birds* (Fuller 1987) but it does appear in the second (2001), before *Caloenas maculata* was officially declared extinct by BirdLife International. Ignoring the fact that Latham (1783) named it Spotted Green Pigeon, and that it has been known by that name ever since, Fuller referred to it as 'Liverpool Pigeon' and, in his own words stated that '... there is no reason to suppose it other than a valid—and now extinct—species from an undetermined South Pacific island.'

Gibbs in Gibbs *et al.* (2001) examined the specimen and was also convinced of its specific status. However, he questioned whether it should be considered a *Caloenas* as, aside from the glossy green plumage and elongated neck feathers, the long tail, slender bill and delicate legs bear no resemblance to Nicobar Pigeon.

Still rejecting the name given by Latham, Fuller (2002) again called it Liverpool Pigeon. Obviously based on Fuller's misnomer, BirdLife International declared the 'Liverpool Pigeon' officially extinct in 2008. On the species factsheet on their website (October 2014), they further erred by stating that the extant specimen was collected between 1783 and 1823. Finally, Hume & Walters (2012) mentioned the species with its correct English name, but did not contribute any new information. They referred to the Spotted Green Pigeon as an enigma, which indeed is precisely what it remains.

## The Spotted Green Pigeon re-examined

So, although much has been written about Spotted Green Pigeon, very little has *actually been said*. Latham described the species with access to just two specimens, and most subsequent publications are almost entirely based on Latham's descriptions. Even those authors who examined the specimen had nothing new to add to earlier descriptions. However, since Forbes (1898), some discrepancy as to the species' presumed appearance has arisen. In Latham's descriptions, the presence of a knob at the base of the bill, similar to that on the bill of a Nicobar Pigeon, is not mentioned; neither is one shown in the accompanying plate. Forbes on the other hand, convinced that the bird should be classified as a *Caloenas*, argued '...it has the frontal knob apparently fully developed.' He must have specifically instructed Joseph Smit, who produced the illustration of the bird, reproduced as a hand-coloured lithograph for Forbes' publication, to add a knob, despite that the lack of evidence that the specimen ever had one (Fig. 2). Although Fuller (2001) apparently saw the specimen, and must have noticed the absence of any sort of protuberance, he also stated that the species has a knob at the base of the bill. B. J. Small, who drew the species for Fuller (2002), also added a knob (Fig. 3). Only J. Cox, who drew the bird for Gibbs (2001), and had also seen the specimen, correctly depicted the bird without a knob (Fig. 4).

Gibbs gives a thoroughly detailed description of the specimen, although he too, as will be demonstrated below, appears to have missed certain details when he wrote: '....short and rounded wings in combination with a long tail' (Gibbs *et al.* 2001).

The specimen was originally mounted, and the taxidermy was probably carried out by Davies himself. Shortly after it was received from Lord Stanley by the Liverpool Museum it was re-prepared into a study skin, and the data from the stand were copied to a label (Fig. 5). Besides this label, the specimen also bears a (presumably more recent) red type label, a paper label and a textile label. The type label and the paper label are almost certainly from the same period, as the handwriting is the same on both. The textile label is probably the oldest of the three, based on the fact it has 'E. Mus. Derby' for the number pre-printed on it, and no 'Presented by'. This may indicate that these labels were produced during the

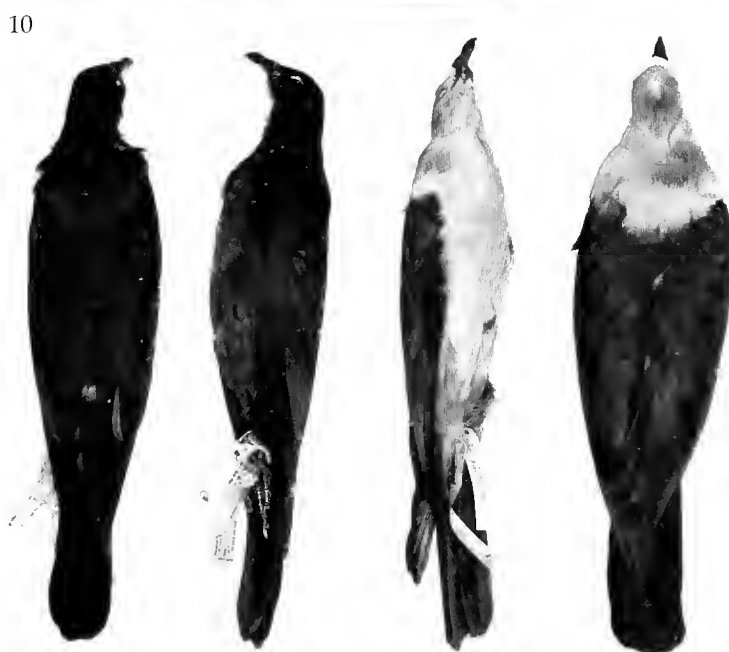
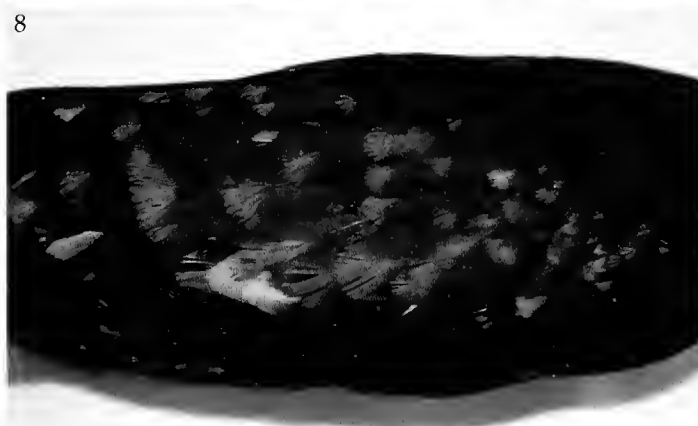
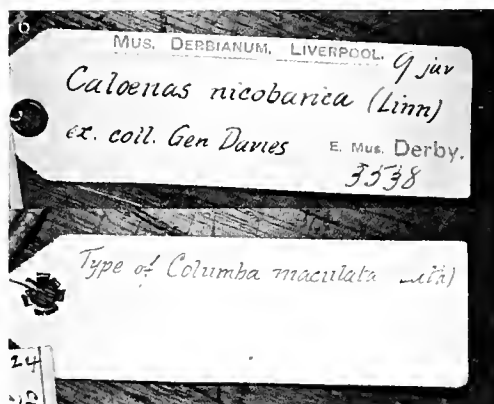
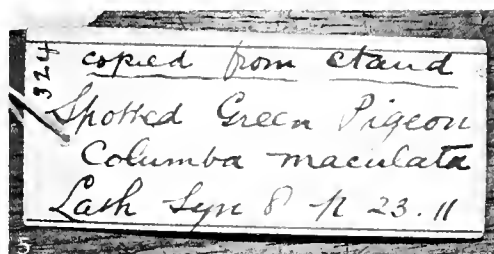


Figure 5. First museum label after the Spotted Green Pigeon *Caloenas maculata* specimen was re-prepared into a skin (Hein van Grouw)

Figure 6. Textile label revealing that a former curator did not believe in the Spotted Green Pigeon *Caloenas maculata* as a species (Hein van Grouw)

Figure 7. Remains of red paint around the right eye socket suggests that the taxidermist thought (knew?) that Spotted Green Pigeon *Caloenas maculata* had red eyes (Hein van Grouw)

Figure 8. The feathers with the buff-coloured spots are clearly more worn than those with white spots (Hein van Grouw)

Figure 9. Rump feathers, from left to right, of Spotted Green Pigeon *Caloenas maculata* (54 mm), Polynesian Imperial Pigeon *Ducula aurorae* (49 mm) and Nicobar Pigeon *Caloenas nicobarica* (38 mm) (Hein van Grouw)

Figure 10. Polynesian Imperial Pigeon *Ducula aurorae*, immature plumage (dark specimen) BMNH 1935.5.27.2 and adult plumage BMNH 1928.10.27.24 (Harry Taylor / © Natural History Museum, London)

period when the museum contained only specimens from Lord Stanley, while in later years, when more new material was being acquired, labels were needed to mention other donors and new registration numbers. The curator who wrote the textile label apparently did not believe that Spotted Green Pigeon was a genuine species as he identified it as a juvenile Nicobar Pigeon. The name *Columba maculata* he added on the back of the label, suggesting it was a synonym of the latter (Fig. 6).

### External features

When the specimen was re-prepared as a skin, the artificial eyes were removed. Given the age of the specimen, glass eyes were not yet available. The fake eyes may have been made of wax as, according to Davies' (1770) own account, this method was used in those days: '....The eyes will be best made by dropping drops of black sealing wax on a card of the size of the natural ones; the card must be cut something larger than the wax to prevent their falling out of the head...'.

After the fake eyes were fixed in the specimen, whether they were wax or not, they must have been painted in the required colour. As some red paint still remains around the right eye socket (visible after carefully removing the kapok used to fill the ocular orbits) it can be assumed that the taxidermist wanted it to have red eyes (Fig. 7). Whether or not this was based on knowledge, the true colour having been recorded while the specimen was alive, or purely an exercise of artistic licence, is unknown. Remarkably, however, the bird pictured by Latham in 1823, which was not apparently based on Davies' specimen, has red eyes too.

When I examined the specimen in November 2012 it was evident that its feet had been attached the wrong way round—the left leg where the right should be and vice versa. Clearly they were detached in the past, probably when it was re-prepared as a skin. However, the feet themselves appeared to be original ones belonging to the specimen. The long toes, large claws and relatively short tarsus are typical of arboreal species, such as imperial pigeons *Ducula*, in contrast to the shorter claws and longer tarsus of the largely ground-dwelling Nicobar Pigeon. In Spotted Green Pigeon (at least, in the way the legs *should* be attached), the base of the tarsus is slightly feathered, especially on the inside. That the illustration in Forbes shows the feathering on the *outside* of the tarsus is evidence that the feet must have been attached wrongly before 1898.

The conspicuous triangular spotting is remarkable, but not unique, in the Columbidae. The nominate races of Spot-winged Pigeon *Columba maculosa* and Speckled Pigeon *C. guinea* possess similar spotting, the result of a natural lack of melanin deposition during early feather development.

The yellow-buff colour of the spots in Spotted Green Pigeon is possibly the result of staining during life, or perhaps represents a different plumage, as these feathers are all very worn, while less worn feathers have clear white tips (Fig. 8), suggesting fresher plumage. In general, the plumage exhibits substantial wear and the overall coloration of the underparts is rather dull. The green iridescence is not as strong and glossy as that of an adult of any other species with similar plumage—e.g. Nicobar Pigeon and the many imperial pigeons—and more closely resembles the colour of juveniles of these species. Although the plumage is not suggestive of a juvenile, it does not appear to be adult either as will be demonstrated in the Discussion.

Although not scientifically underpinned, the feel of the plumage is remarkably soft, and in that respect rather unpigeon-like. Also, the body feathers are rather long in relation to the size of the bird, which is probably, at least partially, the reason for their softness (Fig. 9). Unlike Nicobar Pigeon, the hackles are not extra-long in proportion to the rest of the body

plumage; it is the pointed shape that gives the elongated impression. In microstructure, the feathers do not differ from those of other pigeon species.

Another remarkable feature is the pigmentation. The body feathers of Spotted Green Pigeon are heavily pigmented all over (except, of course, the tips; Fig. 9). Normally, birds with dark body plumage have paler down feathers, but in this case the down is also heavily pigmented. This is usually only seen in aberrant, melanistic, dark plumage (pers. obs.).

Perhaps the most unexpected finding is that the wings were not as short and rounded as they at first appear. Close examination of the specimen reveals that in both wings the five outer primaries are missing. They have not been clipped or broken off as there are no quill remains present; the primaries must have been removed (pulled out) just before or after death. Based on the length and space between the remaining primaries one can estimate that the wing may have been c.50 mm longer (Table 1).

Discussion

That Spotted Green Pigeon did not have short, rounded wings makes it reasonable to believe it was not a ground-dwelling species after all. Although the total body length of a live bird cannot be reliably interpreted from a study skin—which may be stretched or compressed depending on the personal style of the taxidermist—overall, Spotted Green Pigeon appears to have been slightly smaller than the average Nicobar Pigeon (cf. Table 1). The body proportions, however, are totally different. The longer tail and shorter legs, in combination with the longest primaries reaching at least to the middle of the tail, suggest that in proportions and shape Spotted Green Pigeon was probably more comparable with the imperial pigeons *Ducula* spp. The feet, which are typical of fruit pigeon species foraging in trees, strengthen this argument. The coloured bill and presumably coloured eyes are also features of many fruit pigeon species, while the Nicobar Pigeon has a black bill and rather dark eyes. Dark eyes are a common feature in ground-dwelling species that feed mainly on the forest floor.

The green, metallic plumage of Spotted Green Pigeon does resemble that of Nicobar Pigeon, but is commonly found among imperial pigeons. Neither are the tapering hackles exclusive to Nicobar Pigeon. Different feather structure in the neck area is a rather common feature of the pigeon family and in *Ducula* it is clearly present in New Caledonian Imperial Pigeon *D. goliath*.

Different from all other *Ducula* species, the plumage of Polynesian Imperial Pigeon *D. aurorae* has the same softness as Spotted Green Pigeon, probably also due to its relatively long contour feathers. Interestingly, this species is unique among pigeons in having a distinct intermediate plumage between juvenile and adult (Gibbs *et al.* 2001): dull, sooty black-grey on the head, neck and underparts instead of a paler, ash-grey (Fig. 10). Although

TABLE 1  
Measurements (mm) of Spotted Green Pigeon *Caloenas maculata* (taken by the author) compared to Nicobar Pigeon *C. nicobarica* and Pacific Imperial Pigeon *Ducula pacifica* (from Gibbs 2001). \*Estimated wing length based on a full set of primaries (see main text).

Species	Wing	Tail	bill	tarsus
Nicobar Pigeon	243–264	71–85	21–25	30–44
Spotted Green Pigeon	225*	126	20	33
Pacific Imperial Pigeon	217–256	113–139	20–26	30–34

less extreme, Pacific Imperial Pigeon *D. pacifica* from the Cook Islands also has an indistinct post-juvenile immature plumage, before moulting to adult coloration. Given the overall appearance of the Spotted Green Pigeon specimen, especially the dull, brownish-black underparts (see above), it is possible that this species also had an immature plumage, and that this is an example of it. Adult Spotted Green Pigeon may have been brighter with paler underparts and whiter feather tips. So Latham's illustration (Fig. 1) may have been an accurate representation of an adult Spotted Green Pigeon. We now know that his depiction of longer wings was perfectly correct!

## Conclusion

DNA demonstrates that Spotted Green Pigeon is sufficiently closely related to the Nicobar Pigeon to be placed in *Caloenas* (Heupink *et al.* 2014). Therefore the taxon lies in the extended Dodo *Raphus cucullatus* clade of morphologically very diverse pigeon species. This clade includes, in order of closeness to the Dodo and Rodrigues Solitaire *Pezophaps solitaria*, the genera *Caloenas*, *Goura* and *Didunculus* (Shapiro *et al.* 2002). Most of this clade show a characteristic mixture of terrestrial and arboreal traits, and exhibit a degree of affinity to islands. The same traits have been suggested for Spotted Green Pigeon. DNA prove the taxonomic relationships, but provide no information concerning the species' possible behaviour and ecology. Based on a morphological examination, however, it is probable that in both its appearance and ecology Spotted Green Pigeon was very much like imperial pigeons *Ducula* spp. Therefore it may have been almost entirely arboreal. That its provenance has never been discovered suggests a limited distribution typical of a small and remote oceanic island. Although presumably a strong flier, it may have been rather sedentary, avoiding prolonged flights over open water, like many *Ducula* species (Holyoak & Thibault 1984).

To date, it has been assumed that the ancestor of *Caloenas*, which was closely related to the ancestor of the Raphinae, had, aside from the ability to fly and an affinity for islands, semi-terrestrial habits. There is little we can learn from the incomplete sub-fossil remains of Kanaka Pigeon. Nicobar Pigeon is strongly terrestrial, spending most time foraging on the forest floor (Gibbs *et al.* 2001). Spotted Green Pigeon, however, shows all the characters of a strongly arboreal species and may even, like many other fruit pigeons, have kept exclusively to the dense canopy.

Whether Spotted Green Pigeon was indeed a *Caloenas* with appearance and habits suggestive of *Ducula* we shall probably never know. That the species does belong within the extended Dodo clade, a group of morphologically very diverse pigeon species, is certain.

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# First record of Stout-billed Cuckooshrike *Coracina caeruleo-grisea* in Wallacea, a remarkable range extension from New Guinea

by Hanom Bashari & S. (Bas) van Balen

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On Halmahera, the Campephagidae is represented by five species: Moluccan Cuckooshrike *Coracina atriceps*, White-bellied Cuckooshrike *C. papuensis*, Halmahera Cuckooshrike *C. parvula* (endemic to the island), Common Cicadabird *C. tenuirostris* and Rufous-bellied Triller *Lalage aurea* (endemic to North Maluku) (Coates & Bishop 1997, White & Bruce 1986). Here, we report two observations by HB in the Lolobata section of Aketajawe Lolobata National Park, eastern Halmahera, of Stout-billed Cuckooshrike *Coracina caeruleo-grisea*, which was previously known only from mainland New Guinea, Yapen and the Aru Islands (Beehler *et al.* 1986, Coates 2001, BirdLife International 2012).

The first bird was seen at Ngura-Gogaili, Bololo (01°26'N, 128°28'E), at 890 m in primary forest on limestone, on 18 April 2012. It was identified as a male Stout-billed Cuckooshrike by its typical *Coracina* jizz, large body, heavy bill, rather long tail and generally grey body with black primaries; furthermore, it had black eyes, grey legs, black lores and mask (Fig. 1). It was quiet and appeared to be hunting insects in the trees, c.5 m above the ground, associating with a female Standardwing *Scnioptera wallacii* and Dusky-brown Oriole *Oriolus phaeochromus*.

The second record was at km 32, Miaf (01°13'N, 128°34'E), at 550 m in primary forest, on 11 May 2012. This bird was identified as a female on account of its large size, almost twice that of a nearby male Common Cicadabird, and lack of black mask and lores; the grey forehead and ocular area appeared to have a rufous hue (Figs. 2–3). Although it was close to a footpath used by dozens of people daily, the bird perched quietly on a small branch c.10 m above the ground, and appeared to be undisturbed by the observer's presence.

## Discussion

Stout-billed Cuckooshrike comprises three subspecies, differing mostly in size and overall colour: *C. c. strenua* in west and central New Guinea (east to the Wahgi Valley), and on Yapen Island, which is darkest and intermediate in size; *C. c. caeruleo-grisea* in south-central New Guinea and the Aru Islands, which is the smallest and palest form; and *C. c. adamsoni* in eastern New Guinea, which is the largest taxon, with paler plumage, darker ochre underwing-coverts and axillaries, and on average longer wings and larger bill than *strenua*, but is darker and larger than nominate, with deeper ochre underwings (Mayr & Rand 1936, Taylor 2005). It is unclear if the birds photographed on Halmahera belong to one of these subspecies or to an undescribed taxon. As biometric and plumage differences between existing races are rather subtle (H. van Grouw *in litt.* 2014), and light conditions undoubtedly influenced the colours in the photographs, no conclusion is possible. The pale patch visible on the female's wing-coverts (Fig. 3) does not occur in any of the female specimens examined at the Natural History Museum, Tring (H. van Grouw *in litt.* 2014), but as the bird was photographed while apparently preening (indicated by the lowered wings and bulging rump), the feathers may have been ruffled. Compared to birds from the Papuan mainland, depicted in various handbooks (Coates 1996, 2001), the Halmahera





Figure 1. Male Stout-billed Cuckooshrike *Coracina caeruleogrisea*, Ngura-Gogaili, Bololo, Aketajawe Lolobata National Park, Halmahera, Indonesia, April 2012 (Hanom Bashari)

Figures 2–3. Female Stout-billed Cuckooshrike *Coracina caeruleogrisea*, km 32, Miaf, Aketajawe Lolobata National Park, Halmahera, Indonesia, 11 May 2012 (Hanom Bashari)

birds appear to possess a rather long but large, rather than stout bill. However, without measurements and more material for comparison, conclusions are impossible.

The co-occurrence on Halmahera of five different species of *Coracina*, with a sixth closely related species, Rufous-bellied Triller (*cf.* Jonsson *et al.* 2010), accords with the hypothesis

that Papua represents the cradle of evolutionary radiation for the genus (Taylor 2005). The discovery of Stout-billed Cuckooshrike highlights Halmahera's Australasian avifaunal component, which is more marked than elsewhere in Wallacea (White & Bruce 1986).

In New Guinea, Stout-billed Cuckooshrike inhabits forest, edges, tall second growth and disturbed habitats from sea level to 2,450 m, mainly at 600–700 m, and is generally uncommon, albeit locally fairly common (Coates 2001, Taylor 2005). The Halmahera birds apparently are also rather narrowly distributed altitudinally, analogous to the closely related Buru Cuckooshrike *C. fortis* (Voous & van Marle 1949), which is also local and rare (Coates & Bishop 1997). The apparently restricted range, quiet and inconspicuous behaviour, typical of the species elsewhere (Coates 2001), presumably explains its remarkably late discovery on Halmahera, while demonstrating that the island's forests still harbour avian surprises.

#### Acknowledgements

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# First records of Eurasian Wigeon *Anas penelope* and Great Frigatebird *Fregata minor* in the Andaman and Nicobar Islands, India

by S. Rajeshkumar & C. Raghunathan

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Eurasian Wigeon *Anas penelope* breeds across northern Eurasia and winters widely at temperate and more tropical latitudes, including throughout most of South Asia, in Afghanistan and Pakistan, except high mountains, across Assam, and India and Sri Lanka. Great Frigatebird *Fregata minor* breeds on the Chagos, at least on North Brother Island, and perhaps in the Maldives. It is a regular summer visitor to Sri Lanka, and has been recorded on all mainland Indian coasts, and Lakshadweep (James 2004, Rasmussen & Anderton 2012). The species is widespread in the tropical Pacific and Indian Oceans (BirdLife International 2000), but in the east Indian Ocean it breeds only on the Maldives and Adele Island, Australia (Nelson 2005). Great Frigatebirds rarely use roost islands in South-East Asia (Wells 1999). Records of vagrants are available from Malaysia, the Cocos-Keeling Islands, the Paracel Islands off southern China, the Philippines, Australia and New Zealand (Dearborn *et al.* 2003, Galbraith 2003, James 2004, Trainor 2004). There is no previous record of either species from the Andaman and Nicobar Islands. We report records of both from South Andaman Island: the Eurasian Wigeon was documented photographically (Fig. 1), while the Great Frigatebird is represented by a specimen.

On 14 March 2014, a male Eurasian Wigeon was seen at Sipighat (11°36.203'N, 92°41.383'E), South Andaman. As it was potentially a first record for the Andamans, photographs were taken by SR (Fig. 1). The area where the bird was observed has been permanently inundated since the 2004 tsunami; incursion by tidal water having altered this area. The bird was with Lesser Whistling Duck *Dendrocygna javanica*, Andaman Teal *Anas (gibberifrons) albugularis*, Cotton Teal *Nettapus coromandelianus*, Common Moorhen *Gallinula chloropus* and Purple Gallinule *Porphyrio porphyrio*. The wigeon was larger than the Lesser Whistling Ducks and Andaman Teal, and being a male was easily identified with reference to available field guides (Grimmett *et al.* 2011, Rasmussen & Anderton 2012).

On 3 June 2013, the Forest Range Officer of Manglutan picked up a live frigatebird near the shore at New Manglutan, South Andaman. Next day the bird died and was brought to

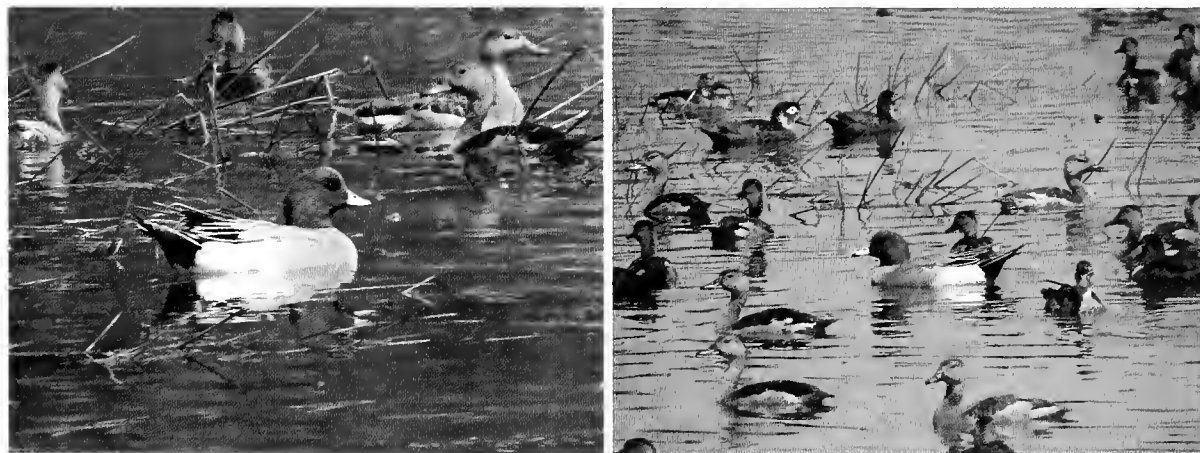


Figure 1. Male Eurasian Wigeon *Anas penelope* with Lesser Whistling Ducks *Dendrocygna javanica*, Sipighat, South Andaman, March 2014 (S. Rajeshkumar)

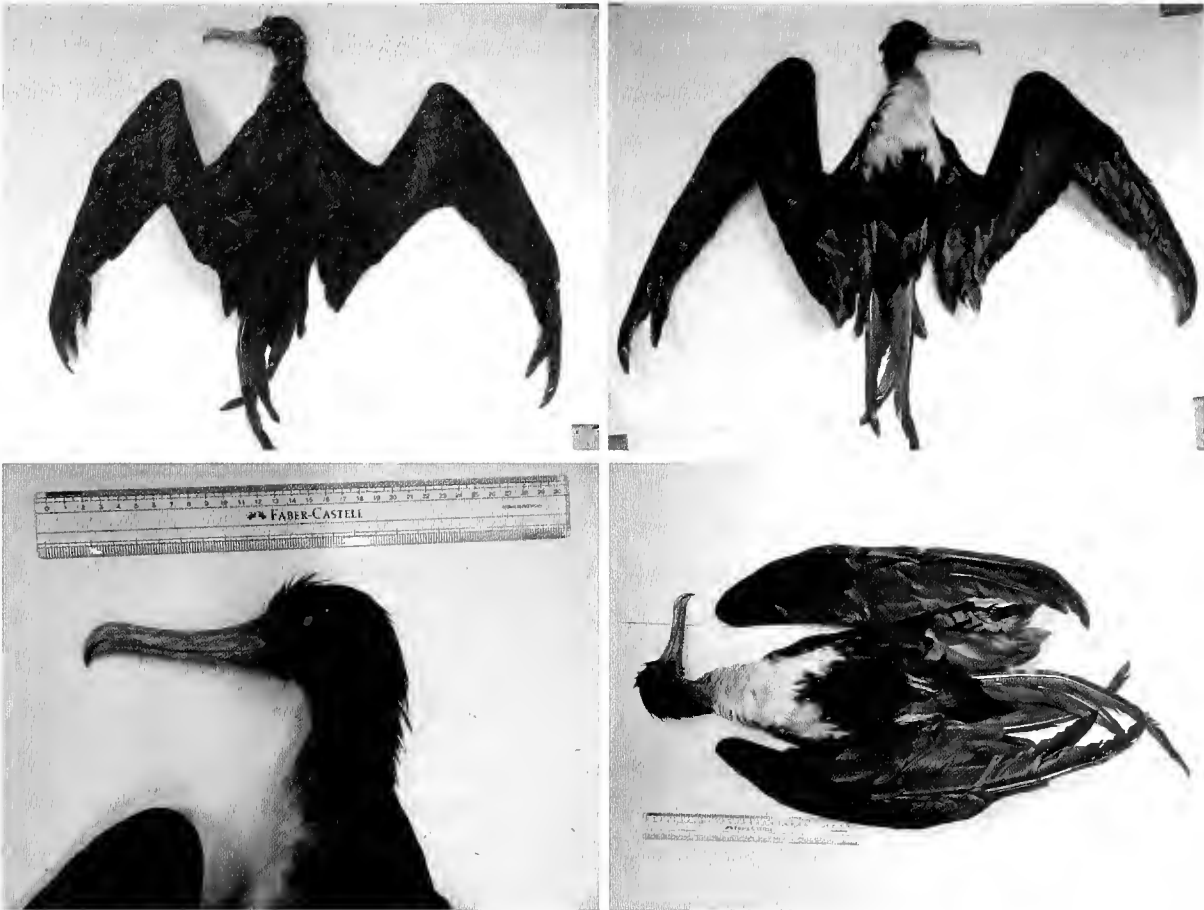


Figure 2. Great Frigatebird *Fregata minor* specimen (ZSI/ANRC/T/3296), New Manglutan, South Andaman, June 2013 (S. Rajeshkumar)

the Zoological Survey of India, Port Blair, where it is now kept as a specimen (ZSI/ANRC/T/3296). Two species of frigatebird are known from sight records on the Andaman and Nicobar Islands: a flock of 28 Lesser Frigatebirds *Fregata ariel* were observed at the southern tip of Great Nicobar and 11 more at Wandoor, South Andaman, in June–July 1997 (Sivakumar & Sankaran 2002), with a single unconfirmed record of Christmas Frigatebird *F. andrewsi* at South Andaman in 1994 (Saxema 1994 in Rasmussen & Anderton 2012).

Our examination confirmed the specimen’s identity as an adult female Great Frigatebird based on the following characters. Mostly black with paler brown bar on upperwing-coverts, pale grey throat grading into white breast and upper belly, but no white spur on underwing; bill and feet reddish (Fig. 2). According to James (2004) the broad, saddle-shaped white breast and flanks, and rounded black belly are diagnostic of adult female Great Frigatebird. The dirty wash to the white breast is typical of many adult females and is not an indication of immaturity (James 2004). Biometrics also match Great Frigatebird (Tables 1–2). Christmas Frigatebird is much longer billed than Great Frigatebird, which in turn has a longer bill than Lesser Frigatebird. Culmen length of the Andaman

TABLE 1  
Biometrics of the Great Frigatebird *Fregata minor* specimen; mass was c.881 g.

Biometric	Measurements (mm)
Length	801
Wingspan	1,350
Wing	585
Culmen	124
Bill depth	18
Tail	458
Tarsus	76
Hind toe	30
Outer toe	56
Middle toe	72
Inner toe	43
Head	156
Iris	17

TABLE 2  
Comparison of biometrics of Lesser Frigatebird *F. ariel* and Christmas Frigatebird *F. andrewsi* (Rasmussen & Anderton 2012) with the Andaman specimen.

Biometrics	<i>F. ariel</i>		<i>F. andrewsi</i>		<i>F. minor</i>		Andaman bird
	♂	♀	♂	♀	♂	♀	
Length	605–630	585–660	740–760	810–880	710–805	740–780	801
Head	128–134	132–143	160–170	180–190	147–160	168–180	156
Tail	300–335	240–340	385–415	379–450	375–460	395–430	458

specimen is longer than females of *F. minor* measured by James (2004), while the total length and tail length of the specimen are greater, and head length smaller than females measured by Rasmussen & Anderton (2012). Nevertheless, it is clear on the basis of plumage and overall size that the specimen is a Great Frigatebird.

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First record of Tolima Dove *Leptotila conoveri* in the Colombian East Andes

by Ana María González-Prieto, Néstor Espejo, Jeyson Sanabria-Mejía, Catalina González-Prieto, Dominic Cormier & Keith Hobson

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Tolima Dove *Leptotila conoveri* is restricted to the east slope of the Central Andes in central Colombia (Hilty & Brown 1986, Stiles 1998, Chaparro *et al.* 2014). Historically, the species was known from just two locations in dpto. Tolima (Toche and Juntas), and two in

dpto. Huila (Isnos and Belén), separated by c.200 km (López-Lanús 2002; Fig 1). Recently, it was reported in dpto. Cauca (Casas-Cruz & Ayerbe-Quiñones 2006; Fig. 1), thereby confirming a historical specimen record from the same department (Biomap Alliance Participants 2014).

The species inhabits humid forest, secondary forest edges, shrubby areas and treed pastures at 1,200–2,500 m (López-Lanús 2002, Casas-Cruz & Ayerbe-Quiñones 2006, Parra-Hernández *et al.* 2007). Tolima Dove requires trees and shrubs for nesting, and although most nest records are from open habitats and coffee plantations, there are no data concerning success and survival rates in modified environments (López-Lanús 2002, Carvajal-Rueda & Losada-Prado 2011). Despite its apparent tolerance for disturbed areas (González-Prieto 2004, Carvajal-Rueda & Losada-Prado 2011), the species is treated as Endangered due to its tiny geographic range and presumably small population, which is considered to be declining due to habitat loss and fragmentation (López-Lanús 2002, BirdLife International 2014). Hunting, nest losses during coffee harvesting, and the taking of nestlings, are known threats (Casas-Cruz & Ayerbe-Quiñones 2006, Carvajal-Rueda & Losada-Prado 2011).

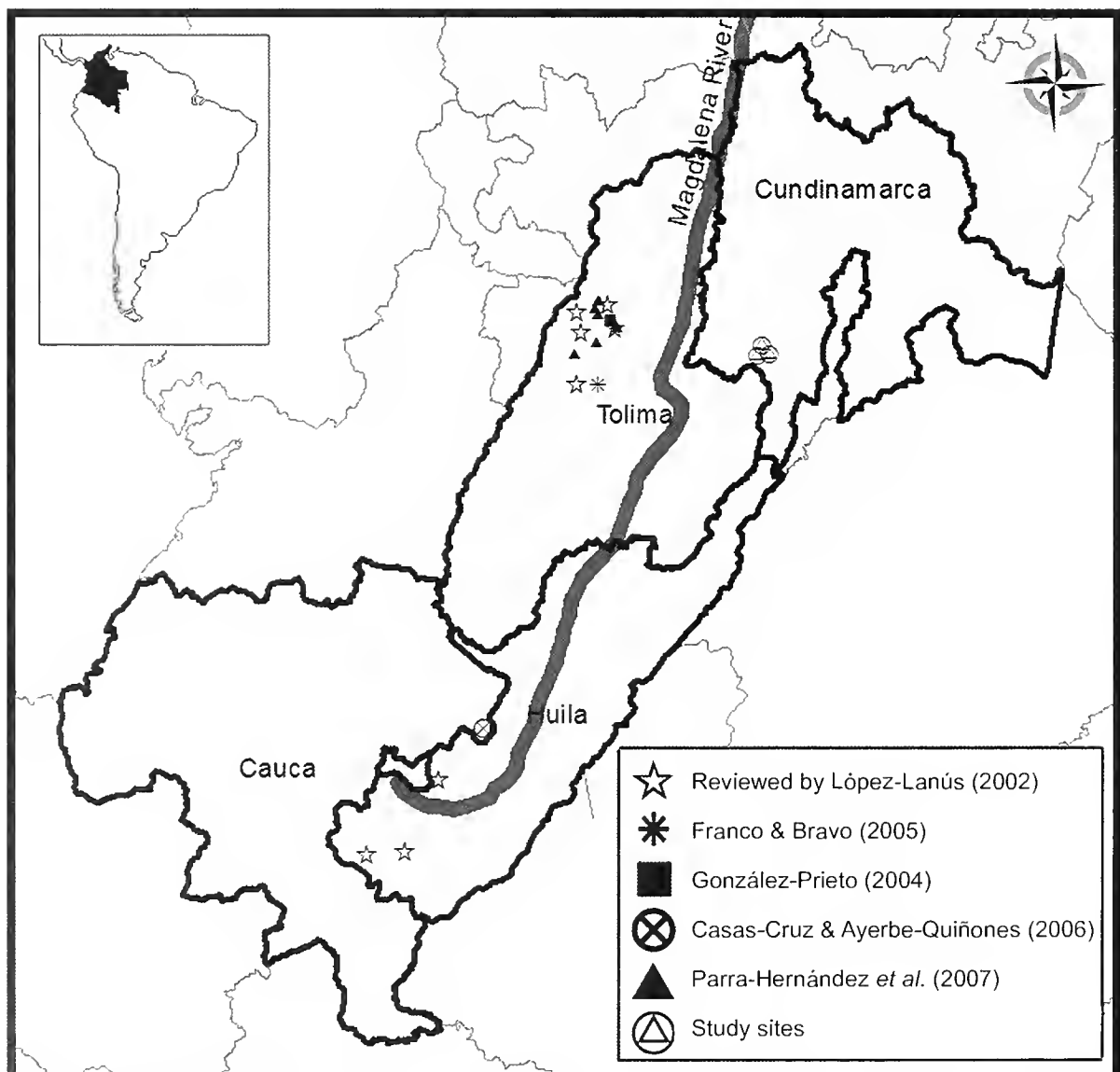


Figure 1. Historical distribution of Tolima Dove *Leptotila conoveri* in Colombia.

We mist-netted the species at three sites in the municipalities of Nilo and Tibacuy, on the west slope of the East Andes (Fig. 1). The first two records were at Finca Puerto López, Vereda Buenos Aires (04°21'56.23"N, 74°31'2.31"W) at 1,350 m, and at Hacienda La Fragua, Vereda Batavia (04°18'54.18"N, 74°32'19.29"W), between 1,500 m and 1,700 m, in Nilo. The third record was at Cerro Quinini Protected Forest Reserve, Vereda La Vuelta (04°19'31.13"N, 74°28'54.69"W) in Tibacuy, at 1,800 m. These localities are dominated by shade-grown coffee plantations, with pastures and small patches of secondary forest. In contrast to previous observations in open and disturbed habitats (Casas & Ayerbe 2006, Carvajal-Rueda & Losada-Prado 2011), we only recorded the species during mist-netting work and transects in mature secondary forest (Fig. 2).

Tolima Dove was recorded in mid-February 2014 at Los Vientos and La Fragua, and in the first week of March 2014 at Cerro Quinini. The species was regularly seen and heard at all three sites until the end of our field season, in the last week of March 2014 (cf. [www.xeno-canto.org](http://www.xeno-canto.org), XC186618–620). The absence of records between December 2013 and late January 2014 suggests that the species went undetected, presumably because it was not the focus of our surveys, or that its presence in the area may result from seasonal movements.

To our knowledge, these are the first records of Tolima Dove in dpto. Cundinamarca and the East Andes. The nearest localities where the species has previously been reported are just 95 km to the west, but presence in a new biogeographic region is significant. Our study sites in the East Andes are separated from the species' known range in the Central Andes by the Magdalena Valley, which represents a significant geographical barrier for many species that inhabit premontane elevations (e.g., Graham *et al.* 2010, Gutiérrez-Pinto *et al.* 2012). Therefore, we consider it unlikely that the species dispersed to lower elevations in the Central Andes and moved across the Magdalena Valley. Our records suggest that the species might be continually distributed south-west from dpto. Huila, through the poorly known western-slope forests in the southern Eastern Cordillera. Its presence in the East Andes might represent a relict population reflecting historical distribution, or a recent colonisation. Exploration of other sites in the East Andes at similar and lower elevations is required to determine the species' distribution in this range. Further work at our study sites will aim to assess the species' phenology and the importance of the remaining forest for its conservation in the region.

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Figure 2. Tolima Dove *Leptotila conoveri*, Hacienda La Fragua, municipality of Nilo, dpto. Cundinamarca, Colombia (Ana María González-Prieto)



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## The collection of Maximilian, Prince of Wied, with particular reference to the type of *Falco tyrannus*

by Mary LeCroy, Christophe Gouraud & Steven van der Mije

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As a result of research into specimens collected by Maximilian, Prince of Wied (1782–1867), held in the Collection Baillon, Musée George Sand et de la Vallée Noire, La Châtre, France, one of us (CG) recently discovered that both the American Museum of Natural History (AMNH) and Naturalis Biodiversity Center, Leiden (RMNH) claim types of *Falco*



*tyrannus* Wied, 1820. The specimen in Leiden, a female, is reported to be the holotype (Hoek Ostende *et al.* 1997: 41), whereas the AMNH specimen is said to be the male lectotype (Greenway 1973: 270). We have researched both claims and the results of our investigations follow.

Wied's (1820: 360) description of *F. tyrannus* (now *Spizaetus tyrannus*, Black Hawk-Eagle) was based on a single male (holotype by monotypy) collected by him on the rio Belmonte (Jequitinhonha), southern Bahia, eastern Brazil, in 1815–17. Temminck (*in* Temminck & Laugier de Chartrouse 1821, Pl. 73 and accompanying text; see Dickinson 2001: 46 for use of the date 1821) depicted *F. tyrannus*, Wied, and acknowledged the Musée des Pays Bas (Leiden), Wied, and the Paris Museum at the end of his text, implying that he had seen specimens from Wied, among others. Later, Wied in his *Beiträge* (1830: 84–89) reiterated that he had collected a single male and mentioned that Temminck's plate did not match his specimen and might be a female or perhaps younger. However, Temminck (*in* Temminck & Laugier de Chartrouse 1820: footnote, Pl. 3; see Dickinson 2001: 46 for use of the date 1820) had earlier stated that '...to avoid useless repetition, specimens used for the plates are always housed in the first collection mentioned' [translated from French]. Thus, it is certain that Temminck used a Leiden specimen for the plate but that he had also either seen Wied's specimen and / or had access to his published description.

Hoek Ostende *et al.* (1997: 41) gave no details concerning Leiden's acquisition of the listed type, RMNH 87265, but Temminck frequently received specimens from Wied bearing Wied's manuscript name, which Temminck then illustrated in his *Planches*. In fact he sometimes anticipated Wied's description, using Wied's manuscript name, with credit to 'Pr. Max' before Wied had published it himself. This was usually a result of the long delay between Wied's travels in Brazil and publication of the *Beiträge* (1830). However, in the case of *F. tyrannus*, Wied had published the name in his *Reise* (1820), prior to Temminck's usage of it. Many of Wied's specimens used by Temminck remain in the Leiden collection, but there is no indication that the Naturalis specimen of *F. tyrannus* came from Wied. Checking the extensive correspondence between Temminck and Wied revealed no information concerning this specimen. Furthermore the only clue leading to a connection with Wied is a reference to Wied's travels ('Voy. de Wied') on the bottom of the stand of the specimen thought to be the type of *F. tyrannus*. However, this writing is not in Temminck's hand and is clearly a later addition, probably by Schlegel when he was compiling his catalogue of the Leiden bird collection (Schlegel 1873) in which he described the specimen as from the Wied collection. Given also that this is a juvenile female and that Wied mentioned that it differed from his specimen, the Naturalis example cannot be the holotype of Wied's *F. tyrannus*. It is possible that Temminck studied Wied's specimen during one of his visits to the Wied collection or that he received it on loan and returned the specimen.

The supposed type in AMNH, no. 6381, was first listed as such by Allen (1889: 267), who noted that the specimen had no original label. In fact, it has no label at all except the type label added by Allen. Greenway (1973: 270) made the incorrect assumption that Allen, by listing the specimen as the type, had designated it the lectotype. This did not appear to be Allen's intent; he frequently listed several 'types' (= syntypes) when AMNH had more than one specimen that he identified with Wied's scientific name. Allen's work was careful and thorough, and he was aware that not all types of names introduced by Wied were at AMNH, but thought that their lack was simply a result of the passage of time since the specimens had been collected. Allen was unaware, for example, that Wied had given apparently appreciable numbers of specimens from his collection to others; these have ended up today in collections such as Wiesbaden (Hoffman & Geller-Grimm 2013), Leiden, and Collection Baillon (Gouraud *in press*).

Relevant to the present case, Allen (1889: 212) was aware of Temminck's publication of some of Wied's manuscript names and noted that 'It thus happens that quite a number of the specimens figured in the 'Planche[s] coloriées' are now in our Museum collection.' Allen also lacked lists of types in other museums for reference.

It is further relevant to consider the history of the Maximilian Collection at AMNH. Since its purchase, it has been referred to at AMNH as the Maximilian Collection, notwithstanding that when the Prince is the author of a name, that name is always credited to 'Wied' by the entire ornithological community. Two years before Wied died in 1867, he prepared a handwritten catalogue of his collection. As Allen (1889: 209) said: 'This is of great importance as indicating his latest views respecting the status and nomenclature of his own species. It is unfortunate, however, that his specimens were not numbered, so as to clearly identify each with the entry in the Catalogue, and that the localities where they were obtained were not explicitly stated.' In his catalogue, names that Wied introduced are usually listed under the name that he considered the most appropriate in 1865, with his introduced name followed by 'Wied'. If he collected the species in Brazil, this is usually indicated by 'm. R.' [meine Reise]. This catalogue (Wied 1865) has been posted on the internet by the AMNH Library, where the original is housed. In his catalogue (p. 227) Wied entered his *F. tyrannus* under the genus *Spizaetus* Vieillot, preceded by '?'; this indicates only that he questioned its inclusion in *Spizaetus*. Although Allen worked carefully with this catalogue, despite the difficulty of doing so, he found that it was not a complete record of Wied's collection and that in a few cases a species was entered twice under different generic names 'widely separated in his system of classification' (Allen 1889: 210). It should be used with great care.

To understand the background to the specimens with which Allen worked, it is necessary to investigate the early ornithological history of AMNH. The following details are mostly from an unpublished memoir held in the AMNH Library, written by Elliot in 1915 and published in part in the *American Museum Journal* (Anon. 1915: 133–141) on the occasion of Elliot's 80th birthday, from Allen (1889: 209–212, 1916: 33–36), and from early annual reports of the museum, especially that by Blodgett (1870). The AMNH was founded in 1869 and set about acquiring foundation collections of birds. The first was that of New York resident Daniel Giraud Elliot, who had an important private collection of mostly North American birds and who was known for his scientific expertise. He had traveled widely and was acquainted with the scientific community worldwide. At this time he was planning an extended European trip to study in various museums abroad and was concerned about having to store his collection while he was away. Prof. Albert S. Bickmore, one of the founders of AMNH, suggested that he should make it available to the new museum. 'After a few weeks I decided that rather than risk the collection in one of the store houses in town, where it would be liable to be ruined by dust or moths and in danger of total loss by fire, I would dispose of it to the Museum, which was done, the Trustees gladly availing themselves of the opportunity to secure it; and it was the first material of any kind that the Museum had obtained and really formed the nucleus of the present gigantic institution.' The specimens were then mounted for display and placed on 'turned mahogany' stands by J. G. Bell, a well-known taxidermist in New York city. Elliot was then asked to select specimens for AMNH from collections at that time available for sale in Europe. Two of these contained South American specimens and will be discussed here.

The Maximilian, Prince of Wied, Collection was, in 1869 (two years after Wied's death), for sale by his nephew. In his memoir, Elliot recounted his visit to the Wied palace, where the collection was stored, and commented on the generally good condition of the specimens. He purchased the entire collection then in the possession of the family and had

it 'boxed up and sent to New York.' The collection consisted of some 4,000 mounted birds, as well as other animals, and with it came the catalogue mentioned above.

Elliot next visited Paris, where he selected from the collection of Maison Verreaux. The Verreaux brothers had collected widely and some of their material had gone to the Paris museum, including type specimens, but they also had a large commercial establishment through which they sold specimens (Mearns & Mearns 1992: 470–473). Elliot recounted: 'For several months I passed almost every day going through that collection. As rapidly as I selected birds or mammals as the case might be they were mounted by Ver[r]eaux and shipped to New York. In this way several thousand specimens were obtained, all of which had been properly named according to the nomenclature then accepted, and on their arrival in New York in huge boxes were arranged by Mr. Bickmore.' With this collection came a large catalogue, apparently of the species in the Verreaux Collection, with specimens selected by Elliot marked as to their number and sex.

When all of these specimens had been received, they were to have been put on exhibit, as was the custom of the day. However, the AMNH had no building in which to display them. The first few annual reports document permission given by the Parks Department for the museum to store these specimens in the Arsenal building at 64th Street and Fifth Avenue. Later, space was allotted on the top two floors of the same building to display the specimens to the public. In 1877, the first AMNH building was finished and the specimens were then moved to the new building and put on exhibit. Also during this time the original T-shaped stands of the Wied specimens and the white stands of the Verreaux specimens were replaced by 'turned mahogany' perches '...the labels being carefully removed from the old stands and tacked on the bottoms of the new stands. In a few instances transpositions of labels occurred, but they were generally of such a character as to be easily rectified' (Allen 1889: 210). It was during this period, prior to Allen's arrival in New York, that Elliot made one of his brief returns to the city and was appalled by the carelessness with which the early collections were treated, which he attributed to the lack of scientific staff in the early days of AMNH, and he felt that many valuable specimens had been lost or discarded.

In the annual report for 1883 it was noted that Edgar Mearns made a large donation of study skins of North American and European birds that were to remain unmounted. He was also hired to identify and catalogue the Eurasian birds in the AMNH collection. He began by separating the mounted birds from the study collection and cataloguing them in separate volumes. He completed this work at the end of January 1884.

It was not until 1885 that Joel Asaph Allen was appointed Curator of birds and mammals and began the task of bringing order to the burgeoning collections. To do this, he combined the remaining early collections of mounted birds and arranged them systematically; then they were catalogued together. Regarding the Maximilian Collection, Allen (1889: 209–211) found that in the *Reise* and *Beiträge* 'about 160 species [were] described and named as new, of which about three-fourths are still represented in the Maximilian Collection by the original or 'type' specimens. Whether the others were lost prior to the transference of the collection to New York, or since that time, it is impossible to determine; yet it seems evident that in a few instances the types were either not preserved or were lost before the reception of the collection in this country.' The types that Allen (1889, 1891) found were 'dismounted and transferred to cabinets, thus preserving them from further deterioration'.

In the AMNH catalogue of mounted birds, there are three specimens of *Spizaetus tyrannus* listed: AMNH 6380, unsexed, from the Verreaux Collection and marked as dismounted for the study collection; AMNH 6381, unsexed, entered as from the Maximilian Collection but not otherwise marked; and AMNH 6382, female, from the Verreaux Collection but not otherwise marked. AMNH 6380 has not been found in the study collection. AMNH 6381 is

a formerly mounted specimen lacking any label; it was dismounted by Allen and put with types. AMNH 6382, still mounted, was found among the mounted specimens. It bears a small label attached to its leg with catalogue no. 6382, a printed exhibit label with the no. 6380, changed in ink to 6382, and 'Verreaux Coll.'. The original Verreaux label (no. 45047, ♀, Brésil) is pasted to the bottom of the 'turned mahogany' mount on which the specimen sits.

According to the Verreaux Collection catalogue, Elliot selected three specimens, an adult male, an adult female and an immature. It seems entirely possible that all three specimens at AMNH were from the Verreaux Collection and that one has lost its label. The method of preparation of AMNH 6381 appeared to Allen similar to that of other Wied specimens, but specimens of both collections were mounted in Europe and were probably not dissimilar. It had also been remounted on a 'turned mahogany' stand and had lost the identity that the Wied 'T-shaped' or Verreaux 'white' stands would have provided. Allen assumed that the specimen without a label must be the missing Wied specimen and therefore a male, as Wied had a single male specimen. (The sexes differ only slightly in size.) But because only one of the three specimens obtained from Maison Verreaux can now be found and because one of the three specimens catalogued has no label of any sort, it seems impossible to confirm that the specimen claimed by Allen is the type of *F. tyrannus*.

We must conclude that lacking any connection to Wied's collection the Naturalis specimen of *Falco tyrannus* is not the holotype. The lack of conclusive information concerning the AMNH bird also makes it impossible to fix type status on this specimen. Furthermore, the lectotype designation by Greenway does not follow the *Code* (ICZN 1999), since a lectotype can only be designated from a type series. In this case we have a description referring to a single specimen, so there is no type series.

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## On the juvenile plumage of Spot-tailed Nightjar *Hydropsalis maculicaudus*

by Israel Moreno, Manuel Olivier Grosselet & Georgita Ruiz Michael

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Spot-tailed Nightjar *Hydropsalis maculicaudus* occurs patchily from south-east Mexico to the Guianas, northern Brazil to south-east Peru, north and east Bolivia, eastern Paraguay and south-east Brazil (Cleere 1998, 1999). Its natural history is poorly known (Cleere 1998, Ojeda *et al.* 2014). Cleere (1998) described immature and juvenile plumages as similar to that of the adult female, but with all primaries and secondaries narrowly tipped pale buffish. Here, we provide a detailed description of the species' juvenile plumage.

Between October 2010 and May 2014, we undertook nocturnal surveys from dirt roads at Santa Alejandrina marsh, Minatitlán municipality, Veracruz, Mexico. When caprimulgids were detected by their eyeshine, we turned off the vehicle engine and trapped the birds using a portable round net (CAPERLAN 4×4 240). Birds were banded, aged and sexed, and if possible measured before being released. For ageing, moult criteria and colour contrast were used, as well as descriptions of typical moult strategy (Pyle 1997, Cleere 1998); for sexing, plumage criteria were mainly used. Caprimulgids encountered were Lesser Nighthawk *Chordeiles acutipennis*, Common Nighthawk *C. minor*, Pauraque *Nyctidromus albicollis*, Chuck-will's-widow *Antrostomus carolinensis*, Eastern Whip-poor-will *A. vociferus* and Spot-tailed Nightjar *Hydropsalis maculicaudus*. On 30 May 2014, we trapped two juveniles of the last-named species.

### Juvenile plumage

The following characters were noted in both individuals. Forehead and crown blackish slightly spotted buff or tawny. Nape blackish brown, spotted or barred tawny and cinnamon-buff. Lores and ear-coverts tawny and cinnamon-rufous speckled dark brown (Fig. 1). Beige supercilium, pale malar stripe, throat paler than in adult, chest coarsely mottled cinnamon to buff or tawny. Reddish-cinnamon hindcollar slightly indicated (obvious in adults). Upperparts paler grey-brown, cryptically vermiculated dark brown, with buff-white or tawny spots (lacking adult's distinctive buffy scapular 'V'; Fig. 1). Rump and underparts buffy, barred blackish brown. Wing-coverts barred brown-cinnamon and black, forming



Figure 1. Juvenile Spot-tailed Nightjar *Hydropsalis maculicaudus*, Santa Alejandrina marsh, Minatitlán municipality, Veracruz, Mexico, 30 May 2014 (Israel Moreno)



Figure 2. Juvenile Spot-tailed Nightjar *Hydropsalis maculicaudus*, showing primaries mottled buffish cinnamon or rufous with black, inner primaries slightly tipped pale buffish and secondaries barred pale buff-cinnamon on brown-black background with buffy tips (Israel Moreno)





Figure 3. Rectrices of juvenile Spot-tailed Nightjar *Hydropsalis maculicaudus* (Israel Moreno)



Figure 4. Typical flight-feather growth in juvenile Spot-tailed Nightjar *Hydropsalis maculicaudus*, with buff-cinnamon pattern on black background (Israel Moreno)



slightly buffy spots (in adults these are strongly marked) and underwing-coverts beige-cinnamon and black; primaries mottled buffish cinnamon or rufous with black, inner primaries slightly tipped pale buffish and secondaries barred pale buff-cinnamon with brown-black background and buffy tips (Fig. 2). Tertiaries brown, spotted buff and blackish brown. Rectrices generally like those of adult females, central rectrices (r1) greyish brown barred black, slightly fringed cinnamon-rufous, and outer rectrices (rr2–5) blackish with brown-rufous bars or spots, speckled greyish brown and slightly tipped pale buffish (Fig. 3). In adult females, rr2–5 are dark brown indistinctly barred pale tawny or buff, and tipped buffish brown speckled brown (Cleere 1998). Cleere (1998: 218) had not previously noted that juvenile plumage differs from that of adult females in tail pattern.

Reviewing rectrices moult by caprimulgids (Pyle 1997, Cleere 1998), it appears that most (if not all) species replace their tail-feathers during the first pre-basic moult. It is possible that Spot-tailed Nightjar also does so. Of 32 individuals of the species that we captured between October 2010 and May 2014, only eight were determined as HY/SY (young yet to complete first cycle of basic moult) due to wing moult. Just one SY (second-year bird) banded was male, based on wing pattern and tail coloration (e.g. Cleere 1998). Of eight HY/SY birds, four were sexed as female using tail pattern (Cleere 1998).

Our data suggest that males have slightly longer wings than females: measurements for males ( $n = 5$ ) were 130–139 mm, vs. 125–133 mm from females ( $n = 4$ ). Cleere (1998) reported ranges of 127–146 mm for males and 122–137 mm for females. In contrast, the two juveniles in our study had wings of 105 and 113 mm, respectively, indicating ongoing growth of flight-feathers (Fig. 4). As juveniles have female-like rectrices and still-growing flight-feathers, it was impossible to sex them.

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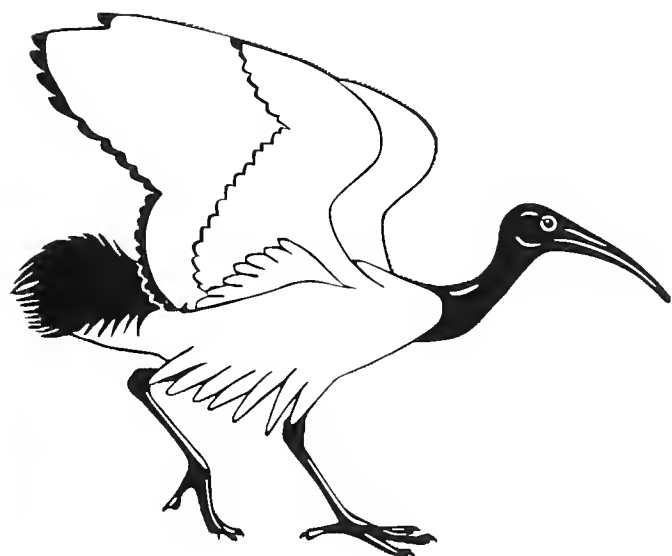
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## CORRECTIONS TO TEXT

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